
Lessons from the North

Canada's Privatization
of Military Ammunition
Production

DISTRIBUTION STATEMENT A
Approved for Public Release
Distribution Unlimited

W. MICHAEL HIX
BRUCE HELD
ELLEN M. PINT

20041008 319

Prepared for the Office of the Secretary of Defense
Approved for public release, distribution unlimited



NATIONAL DEFENSE RESEARCH INSTITUTE

The research described in this report was sponsored by the Office of the Secretary of Defense (OSD). The research was conducted in the RAND National Defense Research Institute, a federally funded research and development center supported by the OSD, the Joint Staff, the unified commands, and the defense agencies under Contract DASW01-01-C-0004.

Library of Congress Cataloging-in-Publication Data

Hix, William M. (William Michael), 1940-

Lessons from the North : Canada's privatization of military ammunition production / W. M. Hix, B. Held, E. M. Pint.

p. cm.

"This report is a companion to Rethinking governance of the Army's arsenals and ammunition plants."

Includes bibliographical references.

"MG-169."

ISBN 0-8330-3634-3 (pbk. : alk. paper)

1. Defense industries—Canada. 2. Canada—Armed Forces—Procurement. 3. Privatization—Canada. 4. Defense industries—United States. 5. United States—Armed Forces—Procurement. 6. Privatization—United States. I. Held, Bruce, 1958– II. Pint, Ellen M. (Ellen Marie), 1960– III. Rethinking governance of the Army's arsenals and ammunition plants. IV. Title.

HD9743.C22H59 2004

338.4'76234'0971—dc22

2004009655

The RAND Corporation is a nonprofit research organization providing objective analysis and effective solutions that address the challenges facing the public and private sectors around the world. RAND's publications do not necessarily reflect the opinions of its research clients and sponsors.

RAND® is a registered trademark.

© Copyright 2004 RAND Corporation

All rights reserved. No part of this book may be reproduced in any form by any electronic or mechanical means (including photocopying, recording, or information storage and retrieval) without permission in writing from RAND.

Published 2004 by the RAND Corporation

1700 Main Street, P.O. Box 2138, Santa Monica, CA 90407-2138

1200 South Hayes Street, Arlington, VA 22202-5050

201 North Craig Street, Suite 202, Pittsburgh, PA 15213-1516

RAND URL: <http://www.rand.org/>

To order RAND documents or to obtain additional information, contact

Distribution Services: Telephone: (310) 451-7002;

Fax: (310) 451-6915; Email: order@rand.org

Preface

The U.S. Army owns more than a dozen plants that today manufacture ammunition, ammunition components, and other ordnance materiel such as gun tubes and gun mounts. Some 70 completely private plants, at which the Army spends roughly two-thirds of its ammunition dollars, complement this government-owned base. In contrast, during the period 1965–86, Canada privatized all its government-owned munitions plants, achieving beneficial results.

This report is a companion to *Rethinking Governance of the Army's Arsenal and Ammunition Plants*, a report published by the RAND Corporation's Arroyo Center (Hix et al., 2003b). That report recommends that the Army privatize most of its government-owned ammunition plants and divest of two of its arsenals. This case study addresses the applicability of Canada's experience should the United States decide to follow the Canadian example by privatizing its ammunition plants along the lines of RAND's earlier recommendations. Familiarity with the earlier report is essential to a thorough appreciation of the context in which this case study's findings and recommendations are made. The earlier report may be obtained from RAND (www.rand.org/publications/MR/MR1651/).

This study's findings should interest all who are concerned with the U.S. defense industrial base and governance alternatives for the government-owned portion of that base.

This research was conducted for the Deputy Under Secretary of Defense (Industrial Policy) within the Forces and Resources Policy Center of the RAND Corporation's National Defense Research Insti-

tute, a federally funded research and development center sponsored by the Office of the Secretary of Defense, the joint staff, the unified commands, and the defense agencies.

For more information on RAND's Forces and Resources Policy Center, contact the Director, Susan Everingham, susane@rand.org; 310-393-0411, extension 7654; or RAND Corporation, 1700 Main Street, Santa Monica, California 90407-2138. More information about RAND is available at www.rand.org.

The RAND Corporation Quality Assurance Process

Peer review is an integral part of all RAND research projects. Prior to publication, this document, as with all documents in the RAND monograph series, was subject to a quality assurance process to ensure that the research meets several standards, including the following: The problem is well formulated; the research approach is well designed and well executed; the data and assumptions are sound; the findings are useful and advance knowledge; the implications and recommendations follow logically from the findings and are explained thoroughly; the documentation is accurate, understandable, cogent, and temperate in tone; the research demonstrates understanding of related previous studies; and the research is relevant, objective, independent, and balanced. Peer review is conducted by research professionals who were not members of the project team.

RAND routinely reviews and refines its quality assurance process and also conducts periodic external and internal reviews of the quality of its body of work. For additional details regarding the RAND quality assurance process, visit www.rand.org/standards/.

Contents

Preface	iii
Figures	xi
Tables	xiii
Summary.....	xv
Acknowledgments	xxv
Abbreviations	xxix

CHAPTER ONE

Introduction	1
Background	1
The International Context of Privatization in the Late 20th Century	2
Military Ammunition Manufacturing in the United States:	
A Contrast in Philosophy	5
Objectives and Approach	6
Organization of This Report	8

CHAPTER TWO

Defense-Related Ammunition Manufacturing in Canada Today	9
Canada's Defense Industrial Base	9
SNC TEC's Ammunition Business Base	13
SNC TEC's Ammunition Manufacturing	15
SNC TEC'S Three Manufacturing Sites	16
Le Gardeur LAP Plant	17
The Saint Augustin Metal Parts Plant	21
Valleyfield Propellant Plant	21

CHAPTER THREE

Creation and Transformation of the Canadian Ammunition

Industrial Base	25
Development of the Government-Owned Ammunition Industry	25
The First Wave of Privatization in the 1960s.....	31
Decline of Ammunition Manufacturing and the Development of an Industrial Base Policy	33
Preparing CAL for Privatization	35
SNC Becomes Canada's Principal Ammunition Supplier.....	39
The Continuing Evolution of Industrial Base Policy	47
Changes in Ammunition Contracting Policy.....	48
Summary.....	49

CHAPTER FOUR

Military, Economic, and Political Context of Ammunition

Manufacturing in the United States and Canada	53
Military Context	54
Economic Context	56
Political Context	58

CHAPTER FIVE

Summary of Insights Gained from Study of the Canadian

Experience.....	63
Summary of Findings	63
Canadian Government Satisfied with the Results of Privatization	63
Canadian Experience Valid for the United States	64
Preparation of Plants for Sale Enhances Their Attractiveness	64
Potential Role of States in the Disposition of U.S. Ammunition Plants	65
Competition Matters	66
Privatization Does Not Relieve the Government of the Need for an Industrial Base Policy	66
Bankruptcy of a Private Supplier Does Not Necessarily Create a Crisis for the Government	68
Selection of Buyers Matters	68
Contract Types Matter.....	68

The Congeniality of the Canadian Political System to Privatization	69
Advantages of Gradual Privatization	69
Providing for Affected Employees Is Essential	69
Final Words on the Relevance of the Canadian Experience for the United States	70
 APPENDIX	
A. History of SNC	73
B. U.S. and Canadian Export Policies	83
C. Valuation of Canadian Arsenals Limited	89
 Bibliography	 93

Figures

2.1.	Canadian Ammunition Budget, 1983–2002	12
2.2.	SNC TEC Ammunition Production Labor Hours Attributed to Domestic and International Customers	14
2.3.	Locations of SNC's Ammunition Plants and Headquarters	15
3.1.	CAL Income and Excess of Income over Expense, 1970–1985	37
3.2.	SNC Revenues and Total Employment, 1978–2002.....	40
3.3.	Chronology of the Privatization of Ammunition Manufacturing in Canada	50

Tables

2.1.	DND Expenditures for Ammunition and Payments to SNC	13
2.2.	Comparison of Attributes of SNC TEC Manufacturing Sites ...	17
2.3.	Current Production Levels at Valleyfield	22
3.1.	CAL Divisions and Plants in 1960	30
3.2.	SNC-Lavalin Defense Revenues and Operating Income	46
4.1.	Selected Statistics for United States and Canada, 2002	53
A.1.	SNC Group Revenues	75
B.1.	U.S. and Canadian Exports of Defense Materiel by Region.....	87
C.1.	Estimated Valuations of CAL.....	91

Summary

Background

Industrialized, Western nations with modern armies typically get their military materiel, including ammunition, from private-sector providers. By contrast, the U.S. Department of Defense (DoD) spends about one-third of its ammunition dollars in plants that are either wholly owned and operated by the U.S. government or are owned by the government but operated by contractors.

Between 1965 and 1986, Canada transitioned from government to private ownership of its domestic ammunition-manufacturing base. Today, that domestic production base consists entirely of private production facilities that earn the bulk of their revenues from sales to other countries, while still providing the Canadian military with its needed munitions. The Canadian example raises the question of whether that nation's experience might offer some useful lessons for the United States.

DoD's selection of Canada for this case study is particularly apt. The successful privatization of the United Kingdom's industrial base has already been well documented. The privatization of Australia's ammunition base, while apparently successful, is more recent and therefore lacks the longer experience that Canada now has with privatization. Hence, the Canadian experience provides a useful case study because the privatization has had almost two decades to mature but has not received wide examination outside that country.

This Report

The following contains the results of a case study of the privatization of Canada's government-owned ammunition plants. It documents the long history of Canada's reliance on a mix of private and public munitions plants, culminating in complete privatization less than 20 years ago.

The case study was done at the request of the U.S. DoD to determine what lessons, if any, the Canadian experience might offer should the U.S. Army consider privatizing its government-owned plants. To complete the study, we drew on published documents as well as a series of interviews with officials from the Canadian government and from the commercial firms that now provide the Canadian military with its ammunition.

This report is a companion to *Rethinking Governance of the Army's Arsenal and Ammunition Plants*, a report published by RAND's Arroyo Center (Hix et al., 2003b). It should be read within the context of the earlier report, which is intended to be distributed with the report at hand.

We undertook the present research with a substantially documented conclusion from the companion report that privatization of the U.S. ammunition base offers a high likelihood of achieving substantial net benefits for the nation. Hence, we did not begin the research with a blank slate. Further, the research embraces the canonical approach to cost-benefit analysis that, in a capitalist economic system, private ownership of capital is to be preferred to government ownership unless it can be shown that government ownership yields greater long-term benefits than does private ownership. Therefore, while we entered the research at hand with open minds about the Canadian experience, we were appropriately informed by and grounded in the earlier research in Hix et al., 2003b.

Canada Is Not the United States—but Does It Matter?

Canada differs from the United States along many dimensions. One of the most obvious is in the size of its population and the corresponding size of its military. The Canadian military is about one twentieth the size of that in the United States, and Canada's defense expenditures are about one-fiftieth of those of the United States. Accordingly, Canada's defense industrial base is substantially smaller than that of the United States. Another significant difference is the focus of the respective militaries. The U.S. military has a global orientation. Canada, its commitments to the North Atlantic Treaty Organization notwithstanding, has more of a domestic focus.

Political differences are also large. The United States elects the members of both houses of Congress and the president directly (the latter through the Electoral College). By contrast, under Canada's parliamentary system, only the members of the lower house, the House of Commons, are elected directly. Members of the upper house, the Senate, are appointed for life. The prime minister and his cabinet are members of the House of Commons and are drawn from the majority party in power. The prime minister is the leader of the majority party and thus has considerable influence in the House of Commons, the source of legislative proposals. Furthermore, members of the Canadian lower house are subject to less frequent elections than are members of the U.S. House of Representatives. The conclusion is that the Canadian majority party has relatively more power than does its U.S. counterpart and, when elected on a broad mandate, is more capable of implementing its vision. This political setting posed no significant impediment to Canada's privatization.

Some would argue that these very substantial differences render the Canadian example moot. Our analysis suggests that this is not the case. While it is true that the U.S. ammunition base is much larger than that of Canada, in reality it employs a relatively small number of government workers, who operate only 3 of 14 ammunition plants. Government employment at the other plants is small, generally consisting of a handful of government employees who administer contracts and attend to safety and command and control matters. While

the process of privatization might be more complicated politically, the deliberate process Canada employed could also work in the United States. Furthermore, some of the same issues addressed in the Canadian privatization effort would have to be dealt with in the United States—e.g., employees with vested government benefits and environmental liabilities.

Insights from the Canadian Experience

The case study offers a number of insights of potential relevance to the U.S. industrial base.

Canadian Government Satisfied with the Results of Privatization

Privatization of Canada's ammunition industry has had positive economic results. Employment has increased at existing plants since privatization. While the prices the Canadian government pays for ammunition are not made public, the private owners of Canadian plants operate efficiently enough to thrive in international markets. Both government officials and private manufacturers report that prices have steadily declined since privatization. Interviews with government officials revealed no interest in returning to government ownership of plants. Despite sharp declines in government ammunition procurement, employment and production at all three plants that produce ammunition have increased since privatization, and the plants' global market share has increased dramatically. At the same time, plant productivity has improved, lowering prices to the government.

Nevertheless, lack of access to detailed cost and price data precludes a quantitative assessment of the precise extent of reduced cost to the government. That said, we found in interviews as well as the academic literature no enthusiasm for return to government ownership.

Canadian Experience Valid for the United States

The positive outcomes the Canadians report—increased employment and lower prices—resulted from the incentives private owners had

after privatization to expand their business base, not from the relatively small size of the base. In fact, the larger U.S. government procurement could provide even greater opportunities for efficiencies and savings than are possible in the relatively modest Canadian ammunition budget.

Preparation of Plants for Sale Enhances Their Attractiveness

In preparation for the 1986 privatization of the Canadian Arsenals Limited (CAL) plants, the crown corporation¹ undertook an eight-year program to streamline its operations, rejuvenate its management, increase its revenues, and improve its profitability. Between 1978 and 1985, the organization was able to turn annual losses into steadily increasing excesses of income over expenses and increase its income by more than tenfold. Without these preparations, the plants would have been more difficult to sell and, if sold, would have fetched a far lower price, consistent with the financial prospects of the plants. This lesson is most important to the U.S. government-owned, government-operated plants and arsenals. These entities, like CAL in the 1970s, now require substantial supplemental funding on top of customer revenues to break even. Accordingly, the transitional step of creating a federal government corporation to improve their business processes and financial picture before attempting to sell them could be helpful. For the government-owned, contractor-operated (GOCO) plants, whose operators are now profitable, the preparation problem is less significant. Before selling the GOCO plants, the government would need to concern itself with the condition of the physical plant, demonstrating the viability of tenant activities, and ironing out the transitional issues associated with the environmental liabilities, which need not be remediated before sale if the land is to be used for a like purpose.

¹ Crown corporations are analogous to federal government corporations (FGCs) in the United States. Like FGCs, crown corporations are organized and operated to execute national policy.

Potential Role of States in the Disposition of U.S. Ammunition Plants

Because the Canadian firm that bought the ammunition plants was reluctant to take on the environmental risk at one of the production sites, the Province of Quebec took ownership of the land from its former private owner as a way of ensuring continued production and employment at that environmentally mistreated property. While U.S. law precludes the same action, a state may share use of federally owned property.

Competition Matters

SNC Technologies, which bought the ammunition plants owned by CAL in 1986, enjoys a near-monopoly in providing munitions to the Canadian government. But it must also compete in often protectionist international markets. As a result, the Canadian government benefits from the increased productivity and efficiency that SNC achieves because of competitive pressures on its international sales. The size of the U.S. market and the number of U.S. manufacturers would likely result in competition even for U.S. government contracts after privatization of U.S. plants, thereby providing competitive incentives even if the plants were unable for some reason to compete internationally.

Privatization Does Not Relieve the Government of the Need for an Industrial Base Policy

Regardless of whether a domestic industrial base is public or private, so long as the government has an interest in its continued existence it needs a set of policies concerning the following:

1. Which items will be manufactured domestically?
2. To what extent will the base be subjected to competition?
3. To what extent will the government subsidize a privately owned base?
4. Will private firms in the base be permitted to fail financially?

The central point here is that privatization does not obviate the need for an industrial base policy. It does, however, obviate the need for government management of plants.

Bankruptcy of a Private Supplier Does Not Necessarily Create a Crisis for the Government

Despite the financial failures of private owners at Valleyfield, one of the privatized plants involved in Canadian ammunition production, government requirements continued to be met. Bankruptcies often mean only financial reorganizations from which the firm emerges stronger than before. Hence, fear of bankruptcy should not deter privatization. Virtually the entire U.S. industrial base is already privatized, including 70 plants that receive about two-thirds of U.S. ammunition dollars.

Selection of Buyers Matters

In 1986 when the Canadian government decided to privatize CAL, because of the lessons it learned from the earlier sale of its Valleyfield plant to disappointing owners, it invited only a handful of highly qualified firms to bid. It was more interested in ensuring reliable, responsible manufacturing than it was in generating the highest possible proceeds from an investor unschooled in the business. A similar approach might serve the United States as well in any future privatization.

Contract Types Matter

After the 1986 privatization of ammunition production, the Canadian government continued with cost-plus contracts that lacked incentives for improved productivity (so that profits were shielded to a large extent from competitive cost pressures). When government purchases declined, the firm that bought the ammunition plants realized it needed to compete internationally to grow its business and survive in the face of sharply declining government purchases. Accordingly, it and the government agreed to new contract vehicles that provided incentives for the firm to become more efficient and share in the rewards of improved productivity.

The Congeniality of the Canadian Political System to Privatization

As discussed above, the parliamentary system of Canada generates less organized local political opposition than is the case in the United

States, making U.S. privatization more difficult and possibly explaining in part the continued government ownership of the U.S. base.

Advantages of Gradual Privatization

The sequential privatization followed by the Canadian government enabled it to learn from each prior experience and provided long-term lessons. Most important, because of its experience with privatization, the government restricted its 1986 solicitation to only a handful of stable, reliable, experienced Canadian firms. Further, the early experience mitigated any residual anxiety in the Canadian Department of National Defence (DND) and in the Canadian forces about privatization. This aided the political process.

Providing for Affected Employees Is Essential

In the 1986 privatization, the government worked closely with the commercial firm that took over the ammunition production to ensure that employees would not lose vested benefits as a result of privatization.

Final Words on the Relevance of the Canadian Experience for the United States

Opponents of privatization of U.S. Army plants typically offer variations on one or more of the following three arguments in favor of the status quo: The private sector will not respond to the competition for sale of government ammunition plants, privatization will increase costs to the government, and private ownership is too risky.

With respect to the first argument, a potential lack of responsiveness on the part of ammunition manufacturers, the Canadian experience is instructive. Lack of private interest was simply not a problem. In the 1960s, private Canadian firms initiated purchase offers for three CAL plants that at the time the government had not even yet decided to sell. And in the government-initiated privatization of the remaining CAL plants in 1986, five invited firms and even

one uninvited firm responded with offers. At least two firms have made overtures to the U.S. Army about buying two of its plants. Nevertheless, one cannot predict in advance of actual offers the extent of competition for U.S. plants if the government offers them for sale. But the government bears no financial risk in offering the plants for sale; it need not accept unattractive offers. The uncertain demand for plants reinforces the need for a gradual approach to privatization, such as the one the Canadians employed.

The second argument, increased costs, has not been borne out in the Canadian experience. Canadian government officials report improved productivity and lower prices, particularly in the 1986 privatization. SNC's competitive position in the international ammunition market reinforces the value of the incentives competition provides to improve a firm's efficiency. Today, the U.S. government-operated ammunition plants lack such incentives, as do the contractors who operate government plants under long-term facility-use contracts. While Canada lacks domestic competition for SNC, the firm prospers under the competitive pressures of international markets.

The Canadian story bears directly on the third argument, the risks of private ownership. At one of SNC's current plants, Valleyfield, two prior owners went bankrupt without significant production failures. SNC is now bringing that plant into a more competitive position. Certainly, private ownership entails a risk that government ownership avoids. But government ownership forgoes the largely positive results privatization can bring. The Canadian experience illustrates that a firm's financial failure need not equate to substantial risk to national security. If such fears were valid, one might expect the U.S. Army to propose nationalizing the assets of the 70 or so completely private plants that consume about two-thirds of the Army's ammunition dollars.

The research cannot and was not intended to prove that privatization of U.S. plants would achieve similar results. What the research does demonstrate, however, is that Canada, with a long history of government ownership of much of its ammunition manufacturing base, was able to successfully privatize its entire base with positive outcomes and with no apparent regrets. The Canadian government

reports a private domestic base that is competitive in international markets while offering reduced ammunition costs to its government. Despite early financial failures at one privatized plant, the base is now in the hands of financially sound owners.

In sum, while there are no guarantees that the United States can successfully privatize its existing government-owned plants, the Canadian experience provides cause for optimism. The risks of privatizing the U.S. base appear limited and manageable. The Canadian success is reinforced by all of the United States' major allies' continuing reliance on private ammunition manufacturing. Finally, the United States itself already successfully relies on the private sector for most of the dollar value of its ammunition and components. Collectively, these international and domestic policies give cause for optimism that a measured approach to privatization of the U.S. base could bear similar fruit. They do not, however, prove the case.

The Canadian experience offers numerous useful insights into the privatization process. If the United States decides to pursue a similar course, it would do well to study the Canadian experience in detail.

Acknowledgments

We wish to acknowledge several current officials of the Canadian government who gave generously of their time for this project. Gordon Hunter, Director General, Equipment Program Services, National Defence Headquarters, and Michel Hébert, Director, Electronic Strategic Services Directorate, Public Works and Government Services Canada (PWGSC) provided valuable information and insight into the procurement policies, industrial base policies, and ammunition requirements of the Canadian government. Vello Mijal, General Counsel, Ministry of Natural Resources, provided a legal overview of the privatization process and bidding policy based on his perspective as the legal advisor to the Canadian arsenals privatization team during the privatization of CAL in 1986. Maurice Boileau and Luc Lefebvre of the Canadian DND provided government budget and cost data as well as cogent interpretations of the figures.

We wish also to thank the many employees of SNC-Lavalin Group Inc. and its subsidiaries for their hospitality and openness during our visits to their facilities. We are particularly grateful to then-President and Chief Executive Officer of SNC Technologies, Inc. (SNC TEC) Robert Leboeuf, who shared in great depth the unique insights his position conferred about the history and current operations of the firm's ammunition business. We are also grateful for the historical knowledge of Anthony Rustin, former President and CEO of SNC Industrial Technologies Inc. and, at the time of SNC's 1986 purchase of CAL, Senior Vice President of The SNC Group. Michael Novak, who at the time of this writing is the newly ap-

pointed President and CEO of SNC TEC, graciously reviewed an early draft of this report. Brian Berger, Vice President, Business Development, US Programs, SNC TEC, and Randall Sweeney went out of their way on many occasions before and during our visits to ensure that the agenda suited our needs and the appropriate arrangements were made—all with infectious enthusiasm and good cheer.

In addition to these men, we wish to express our appreciation to the following other SNC personnel who briefed us, guided our tours, and patiently answered our questions:

Pierre Bélanger, Vice President, Business Development, Canadian Programs, SNC TEC

André Breton, Vice President and General Manager, EXPRO TEC

Marc Delahaut, Executive Vice President, Business Development, SNC TEC

André Falardeau, Vice President and Chief Financial Officer, SNC TEC

Émile Laroche, Vice President and General Manager, Le Gardeur Plant, SNC TEC

Yves Lefebvre, Director, Development and Technologies, SNC TEC and former General Manager of the Saint Augustin Plant

Alan L. Ross, Washington Representative, SNC TEC

This report benefited substantially from the conferences, discussions, emails, and interviews with former officials of the DND, the Department of Supply and Services (DSS, later PWGSC), and other agencies that participated in the Canadian privatizations. We wish in particular to thank Harry Webster, Partner, CFN Consultants, and former Director General of the Aerospace, Marine and Electronics Sector of PWGSC. Mr. Webster's experience as Director of the Canadian Arsenals Limited Privatization Team gave him a valuable and unique government perspective on the privatization and its results. Mr. Webster and CFN also arranged for us to meet with other former government officials with different vantage points on the privatization. We are particularly indebted to Raymond V. Hession, former Deputy Minister, DSS; Stan Kerr, former Director General of Aero-

space and Armament, DSS; Stan McRoberts, who served at the Treasury Board at the time of the privatization, and Leo Tardif, Vice President for Research and Development at CAL at the time of its 1986 privatization.

Collectively, the individuals mentioned above represent a rich and fascinating source of the history of the privatization of Canada's ammunition manufacturing. We are indebted to them all.

Finally, we wish to thank RAND colleagues Ed Keating and Mark Lorell for their thorough and constructive technical reviews of the draft report.

Abbreviations

AAP	army ammunition plant
ADI	Australian Defence Industries
APFSDS-T	armor piercing, fin stabilized, discarding sabot, tracer
ARDEC	Armament Research and Development Engineering Center
ARMS	Armament Retooling and Manufacturing Support
AVGP	armored vehicle, general purpose
CAL	Canadian Arsenals Limited
CCC	Canadian Commercial Corporation
CIL	Canadian Industries Limited
DCF	discounted cash flow
DND	Department of National Defence
DoD	Department of Defense
DPSA	Defense Production Sharing Arrangement
DSS	Department of Supply and Services
EXPRO TEC	EXPRO Technologies, Inc.
FAPDS-T	frangible, armor piercing, discarding sabot, tracer
FGC	federal government corporation
GD-OTS	General Dynamics—Ordnance and Tactical Systems

GOCO	government-owned, contractor-operated
GOGO	government-owned, government-operated
HCER	high capacity, extended range
HE	high explosive
HEAT	high-explosive anti-tank
HE ER	high explosive extended range
HEI	high explosive, incendiary
HEI-T	high explosive, incendiary, tracer
HESH	high explosive, squash head
HQ	headquarters
IPO	initial public offering
IVI	Industries Valcartier, Inc.
LAP	load, assemble, and pack
MACS	Modular Artillery Charge System
MSP	Munitions Supply Program
NATO	North Atlantic Treaty Organization
PFHE	pre-fragmented high-explosive
PWGSC	Public Works and Government Services Canada
R&D	research and development
SHP	squash head, practice
SH/P-T	squash head, practice, tracer
SIC	Standard Industrial Classification
SNC IT	SNC Industrial Technologies, Inc.
SNC TEC	SNC Technologies, Inc.
SRTPDS-T	short range, target practice, discarding sabot, tracer
TP	target practice
TP-T	target practice, tracer
TPDS-T	target practice, discarding sabot, tracer

TPFSDS-T	target practice, fin stabilized, discarding sabot, tracer
VCP	Valleyfield Chemical Products
WP	white phosphorous

Introduction

This report documents a case study of an important segment of Canada's defense industrial base: ammunition manufacturing. It offers insights that may be useful to U.S. policymakers as they grapple with the future of the U.S. defense industrial base. It serves as a companion to *Rethinking Governance of the Army's Arsenal and Ammunition Plants*, a report published by the RAND Corporation's Arroyo Center (Hix et al., 2003b). It should be read within the context of the earlier report, which is intended to be distributed with the report at hand. Readers of this report will benefit from a familiarity with the analysis, findings, and conclusions of the earlier volume. In particular, readers will benefit from the detailed description of the U.S. ammunition base, its problems, and potential solutions.

Background

All industrialized nations whose defense policies require investment in weapons systems and attendant materiel, such as ammunition, must decide whether to procure such items from foreign or domestic sources. To the extent that a nation decides to procure at least some such materiel from domestic sources, it needs an industrial base policy with a number of features. Among the most significant of these are the following:

2 Lessons from the North

- The conditions under which specific defense-related items will be procured domestically.
- The extent to which defense industrial capabilities are to be government owned rather than privately owned.
- The extent to which the government chooses to subsidize privately owned defense capabilities.
- The extent to which producers will be protected from competition through sole-source contracting, directing workload into government-owned plants, or other policies.
- Whether privately owned defense-related firms will be permitted to fail financially.

This report tells the story of how one government, that of Canada, answered these industrial base policy questions with respect to the production and procurement of military munitions. It documents Canada's decision to maintain a domestic source for most munitions while transforming its base from a predominantly government-owned enterprise to a private one.

But, to fully appreciate that story, it is helpful first to understand the broader international context in which much of Canada's privatization of its ammunition manufacturing was brought about.

The International Context of Privatization in the Late 20th Century

In the 1980s and 1990s, Western democracies undertook broad programs of privatization and deregulation. Participants included the United Kingdom, France, Canada, Australia, New Zealand, and the United States.¹ These policy initiatives were undertaken based on a philosophical preference for private ownership and freer markets and for practical reasons, including raising funds for the government, reducing the costs of subsidies and capital investments in state-owned

¹ This discussion is based on a number of sources, including Levac and Wooldridge, 1997, pp. 25–40; Radygin et al., 2001; Vickers and Yarrow, 1988; Bishop, Kay, and Mayer, 1994.

enterprises, and improving the efficiency of government bureaucracies. In both the U.K. and Canada, privatization policies introduced by the conservative governments of Margaret Thatcher and Brian Mulroney, respectively, were continued and even expanded by their successors, including the more liberal Tony Blair and Jean Chrétien.

In 1984, when Canada's Progressive Conservative Party formed its government, it inherited 61 crown corporations,² with assets of more than CA\$50 billion³ and 207,000 employees. Within ten years, the government had privatized 23 of these government-owned firms and transferred 52,000 jobs to the private sector (McDermid, 1993, p. 3). Between 1986 and 1996, proceeds from the ten largest federal government privatizations totaled CA\$7.2 billion (Levac and Wooldridge, 1997). The largest firms—such as Canadian National Railways, Petro-Canada, and Air Canada—were typically sold to the public in initial public offerings (IPOs), but smaller firms such as Canadian Arsenals Limited (CAL), Canada's crown corporation that manufactured military munitions and some weapons, were sold in negotiated sales or qualified auctions to existing firms.

Canadian provinces and cities also privatized a number of large crown corporations in telecommunications, mining, oil and gas, and other lines of business. The ten largest provincial and municipal privatizations raised over CA\$6.6 billion.

With regard to the subject of this inquiry—ammunition manufacturing—the government of Canada began privatizing its government-owned munitions plants in the mid-1960s, well before the large privatizations of the 1980s and 1990s. The Canadian munitions privatization culminated in the sale of the last vestiges of CAL to The SNC Group, now SNC-Lavalin Group Inc. (hereafter SNC-Lavalin),

² See Chapter Three for a description of crown corporations, what they do, and why they exist.

³ In this report, most dollar figures are in Canadian dollars and are presented in the format CA\$xx. Non-Canadian dollar figures are designated in a similar fashion by nation (e.g., US\$xx). In 1984, the Canadian dollar was worth US\$0.77. Since that time it has varied between US\$0.87 in 1991 and US\$0.64 in 2002. At the end of 2003 it stood at US\$0.71 (U.S. Board of Governors of the Federal Reserve System, *Series EXCAUS, G.5 Foreign Exchange Rates*, updated January 2, 2004.)

in 1986. Private firms now operate all three of the still-active privatized military munitions plants formerly owned by CAL. Further, IMT Corporation, which makes projectiles, and Bristol Aerospace, which produces rockets, have always been privately owned.

Other countries also enacted broad privatization policies that included ammunition production. For example, in the U.K., privatization reduced the share of state-owned enterprises' gross domestic product by over a third between 1979 and 1987, from 11.5 percent to 7.5 percent (Vickers and Yarrow, 1988, p. 1). From 1984 to 1990, the U.K. government raised a total of £37 billion through privatization (Bishop, Kay, and Mayer, 1994, p. 3). The U.K. privatized its government-owned ammunition supplier, Royal Ordnance plc, in 1987. Although the government initially considered an IPO, it later decided to solicit bids from 17 selected firms judged qualified to operate Royal Ordnance. It received six initial bids and eventually accepted British Aerospace's offer of £190 million on the grounds that it was the highest and most commercial bid (U.K. National Audit Office, 1989).

Australia has also recently privatized its ammunition production facilities as a result of the sale of Australian Defence Industries, Ltd. (ADI), in 1999 to a 50-50 joint venture of Transfield Holdings, an Australian construction firm, and the French defense electronics firm Thomson-CSF (now the Thales Group). After a protracted privatization process, the joint venture won with a bid of AUS\$346.78 million in competition with two other final bidders. ADI was created in 1989, when it took over six munitions manufacturing plants that had previously been operated by the Australian Department of Defence's Office of Defence Production. It has since diversified into a wide range of defense production, including shipbuilding; tactical vehicles; command, control, communications, computers, intelligence, surveillance, and reconnaissance; and some related commercial fields.⁴

Other major nations, such as Germany, enjoy a long history of private ownership of defense manufacturing and therefore had no

⁴ See Battilega et al., 2000; "Sale of Defense Industry Co ADI Finalized in Australia," 1999; ADI, 2003.

need to participate in the privatization waves of the 1980s and 1990s. At that time the United States also had relatively few government-owned enterprises but fully or partially deregulated a number of industries in the 1980s and 1990s, including airlines, railroads, interstate trucking, banking, cable television, telecommunications, electricity, and natural gas.⁵

Military Ammunition Manufacturing in the United States: A Contrast in Philosophy

While the Reagan administration led an era of U.S. privatization and deregulation of defense-related and other industries, today the U.S. government continues to own more than a dozen plants that produce ammunition, gun tubes, howitzers, and related ordnance materiel. Further distinguishing the United States from its allies is the practice of its army, rather than other government agencies, to own government munitions plants.

The U.S. Air Force and Navy, as well as the armed forces of the other major nations, lack the U.S. Army's long history of factory ownership that dates to the army-owned foundries of the Revolutionary War (Hix et al., 2003b, pp. 11–14). While the U.S. Air Force and Navy have in the past owned manufacturing shipyards and aircraft plants, such facilities have gradually been privatized; only a handful remain in government hands, and most of them are in the process of being sold to private firms.⁶ This leaves the U.S. Army, as owner and in some cases operator of plants, alone not just among its sister U.S. armed forces but among the armed services of the other major nations as well.

At the behest of the U.S. Army, the RAND Corporation's Arroyo Center recently conducted the study *Rethinking Governance of*

⁵ See, for example, McKie (1989), pp. 27–48.

⁶ In contrast, repair and supply depots remain military owned and are likely to continue this way, despite the development of public-private partnerships and increased privatization of some of the workload, strictly controlled by statute (10 U.S.C. 2466).

the Army's Arsenal and Ammunition Plants (Hix et al., 2003b), mentioned at the beginning of this chapter. The study recommends that the U.S. Army divest itself of the two arsenals and 10 of the 14 ammunition plants.⁷ To date the army has chosen not to implement the RAND recommendations and is instead exploring other options intended to achieve efficiencies while continuing Army ownership of needed plants (Kern, 2003).

This report should be read within the context of the earlier report, which is intended to be distributed with the report at hand.

Objectives and Approach

Noting the difference in Canadian and U.S. policy, the Deputy Under Secretary of Defense (Industrial Policy) asked RAND to undertake the present case study with the purpose of documenting the Canadian experience and assessing what, if any, lessons it offers for future U.S. policy with respect to its continued U.S. government ownership and operation of ammunition and other industrial facilities.

The Department of Defense's (DoD's) selection of Canada for this case study is particularly apt. The successful privatization of the United Kingdom's industrial base has already been well documented. The privatization of Australia's ammunition base, while apparently successful, is more recent and therefore lacks the longer experience that Canada now has with privatization. Hence, the Canadian experience provides a useful case study because the privatization has had almost two decades to mature but has not received wide examination outside of that country.

We undertook this research with a substantially documented conclusion from the companion report that privatization of the U.S.

⁷ The study found no inherent reason for continued government ownership of the remaining four ammunition plants. It makes no recommendations on these four because the installations house a range of nonmanufacturing activities that lay beyond the scope of the study. Further, two of the plants reside on property owned by other government agencies.

ammunition base offers a high likelihood of achieving substantial net benefits for the nation. Hence, we did not begin the research with a blank slate. Further, the research embraces the canonical approach to cost-benefit analysis: In a capitalist economic system, private ownership of capital is to be preferred to government ownership unless it can be shown that government ownership yields greater long-term benefits than does private ownership. Therefore, while we entered the research with open minds about the Canadian experience, we were appropriately informed and grounded in our earlier research (Hix et al., 2003b).

This research relied on published sources as well as interviews and conferences. We visited and collected data from all the now-private Canadian ammunition plants and interviewed officials of the firms that own and operate them. Further, our team interviewed former and current senior officials of the Canadian government who either directed the privatization process or oversee industrial base policy and the procurement of munitions today.

Under ground rules established at the time, information gathered during interviews and conferences is not attributed to individuals by name, except in cases where two or more sources provided conflicting information that could not be resolved. By agreement, the report cites by name several sources contacted subsequent to the interviews and conferences. Published sources receive standard citations.

Reliance on structured interviews as a supplement to published facts and figures has limitations. Personal bias and faulty memories cannot in all cases be discerned. We attempted to overcome these methodological limitations by interviewing sources with widely varying experiences, both government and private, then attempting to collect missing information and resolve conflicting reports through follow-up discussions and correspondence. Where possible, we validated interview results with published accounts.

The central objective of the research was to understand the Canadian privatization process, what motivated it, the details of the process, how satisfied the Canadian government is with the outcome, and what lessons from this experience apply to U.S. policy.

Organization of This Report

Chapter Two describes the Canadian ammunition industrial base as it exists today. Chapter Three traces the key policy changes and historical events that led to today's configuration. Chapter Four compares Canadian and U.S. industrial base policies and practices and assesses the applicability of the Canadian experience to the United States. Chapter Five summarizes findings and conclusions.

Defense-Related Ammunition Manufacturing in Canada Today

This chapter provides an overview of Canada's defense industrial base, with emphasis on its military ammunition sector. It details the manufacturing capabilities of the government's major supplier, SNC TEC, and sets the contemporary context for Chapter Three's story of Canada's path to privatization.

Canada's Defense Industrial Base

Because of Canada's limited defense procurement budget, it cannot support a large domestic defense industrial base.¹ Canada has never attempted to build a self-sufficient base; it has always relied to some extent on imported defense materiel. In 2002–03, the entire Canadian defense budget was CA\$11.8 billion, of which about 19 percent, or \$2.2 billion, was spent on capital procurement (Government of Canada, 2002a, pp. 39–40). About 70 percent of Canadian defense equipment is purchased abroad. However, under certain conditions, Canada's Industrial and Regional Benefits policy requires foreign bidders to offer opportunities for capable and competitive Canadian companies to participate as subcontractors, to include a "Canadian content" by promoting small business development or employing Canadians, or to promote Canadian exports, particularly in the advanced technology service sector.

¹ Except where otherwise noted, this discussion is based on Solomon, 1999.

Unlike the United States, where each cabinet department handles its own procurement actions, Canada has a single government agency that conducts contract negotiations and procurement for all government departments, including the Department of National Defence (DND). Public Works and Government Services Canada (PWGSC), formerly known as the Department of Supply and Services (DSS), has overall responsibility for contract award and management. DND has primary responsibility for setting quantity requirements, technical specifications, and ensuring product quality, but it does not conduct its own contracting. Thus, close coordination between DND and PWGSC is essential for defense procurement, including ammunition (Government of Canada, 1988, Chapter 16).

Most Canadian defense producers depend at least to some extent on exports. Total defense export sales were estimated at CA\$1.2 billion in 1997–98 (Solomon, 1999, p. 14). Canada has a close defense trade relationship with the United States, based on the 1958 Defense Production Sharing Arrangement (DPSA), which has benefited both nations by fostering freer trade in defense materiel. DPSA has allowed Canada favorable access to the much larger U.S. military market; it has also provided a basis for the United States to buy defense materiel. Under the DPSA and U.S. DoD procurement regulations, all defense prime contracts larger than US\$100,000 are contracted through the Canadian Commercial Corporation (CCC). This arrangement accounted for CA\$643 million in sales to the U.S. DoD in 2002–03 (CCC, 2003, p. 18). However, subcontracts negotiated between U.S. and Canadian firms may account for up to 65 percent of U.S.-Canada defense trade (Solomon, 1999, p. 2).

The main sectors of the Canadian defense industrial base are aerospace (including Pratt & Whitney Canada, CAE Inc., Allied Signal, and Bombardier), shipbuilding, ammunition and small arms, defense electronics, and military vehicles (dominated by the former GM Defence, now owned by General Dynamics). The four major ammunition and small arms producers are SNC Technologies, Inc. (SNC

TEC), which performs load, assemble, and pack (LAP)² operations to produce finished munitions; manufactures metal parts for small-, medium-, and large-caliber ammunition; and, through a subsidiary—EXPRO Technologies, Incorporated (EXPRO TEC)—produces explosives and propellants; IMT Corp., which makes metal parts for medium- and large-caliber projectiles; Bristol Aerospace Ltd., which manufactures rocket systems; and Diemaco, a maker of small arms.

The remainder of this report is limited to ammunition manufacturing and, therefore, excludes small arms and other nonammunition production and requirements.

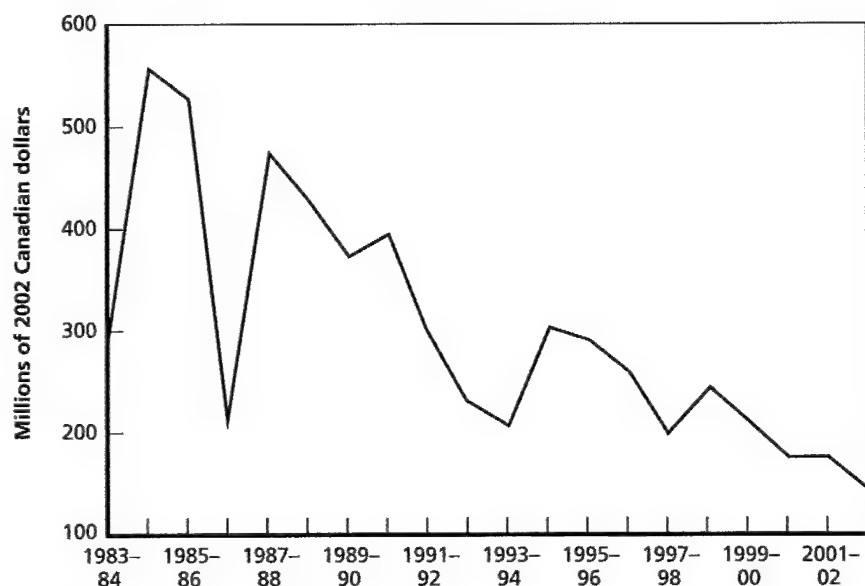
Figure 2.1 illustrates the bumpy but distinct downward trend in the Canadian ammunition budget that has persisted for two decades. Even before the substantial reduction in Canadian forces that followed the end of the Cold War, the trend was discernible amid year-to-year variation. As Canadian ammunition procurement has declined, SNC TEC has chosen to increase export sales to remain viable.

Table 2.1 provides a breakout of the most recent six years of the above Canadian ammunition expenditures. In fiscal year 2002–03,³ the Canadian government spent CA\$149.1 million on ammunition and related costs. This figure has steadily declined from a constant 2002 dollar figure of CA\$259.3 million (\$230 million in then-year dollars) in 1996–97. About 60 percent (\$91.2 million) of the 2002–03 amount of \$149.1 million went to SNC TEC, clearly the

² “Loading” entails adding explosives and propellants into components such as projectiles and shell casings. “Assembling” entails the assembly of components into complete finished rounds. “Packing” entails placing finished ammunition into shipping and storage containers. Collectively, these processes are known by the acronym, LAP.

³ The fiscal years of the Canadian government end on March 31. Hence, fiscal year 2001–02 ended on March 31, 2002.

Figure 2.1
Canadian Ammunition Budget, 1983–2002



SOURCES: For fiscal years 1983–84 to 1995–96, Government of Canada, 1985–97 and 1998; for fiscal years 1996–97 to 2002–03, Maurice Boileau, personal communication, September 4, 2003.

RAND MG169-2.1

dominant ammunition supplier to the Canadian government. DND bought the remainder of its ammunition from foreign suppliers, including U.S. sources.⁴

About 60 percent of the ammunition DND buys goes to the army; the air force is the second largest user. The ammunition program sustainment line includes support costs for ammunition testing at Canada's Nicolet test facility operated by SNC TEC, modernization of SNC's Valleyfield plant, research into more environmentally friendly munitions, and ammunition disposal.

⁴ Canada relies entirely on foreign sources for its missiles and certain major weapons systems principally because of the economics of the small quantities of such materiel the government requires.

Table 2.1
DND Expenditures for Ammunition and Payments to SNC
(in millions of 2002 CA\$)

	Fiscal Year						
	1996– 97	1997– 98	1998– 99	1999– 2000	2000– 01	2001– 02	2002– 03
DND expenditures							
Direct ammunition							
Land	167.3	107.1	119.2	131.6	104.8	114.4	88.4
Air	22.9	38.4	35.4	33.6	42.9	42.6	37.5
Maritime	24.4	16.2	30.4	40.0	25.7	16.7	15.7
Ammunition program sustainment	44.9	37.9	58.2	5.8	3.1	4.7	7.4
Total DND expenditures	259.3	199.4	243.2	211.1	176.6	178.5	149.1
DND payments to SNC	145.1	129.7	122.1	120.3	116.1	110.5	91.2

SOURCES: Nominal dollar figures from DND, Maurice Boileau, personal communication, September 4, 2003. Deflators from Government of Canada, 2003b: 1996–97 = 0.890; 1997–98 = 0.904; 1998–99 = 0.913; 1999–2000 = 0.929; 2000–01 = 0.954; 2001–02 = 0.978; 2002–03 = 1.0.

NOTE: Ammunition program sustainment and SNC payments now include about CA\$5 million a year for operation of the Nicolet test facility.

SNC TEC's Ammunition Business Base

This section turns from the government's purchases to the other side of the market: sales of the principal supplier, SNC TEC. SNC TEC's sales to the Canadian government represent a decreasing share of that firm's total ammunition sales. According to the DND-provided data in Table 2.1, in fiscal year 2001–02 DND paid SNC TEC CA\$110.5 million in 2002 dollars (CA\$108.1 million in then-year dollars).

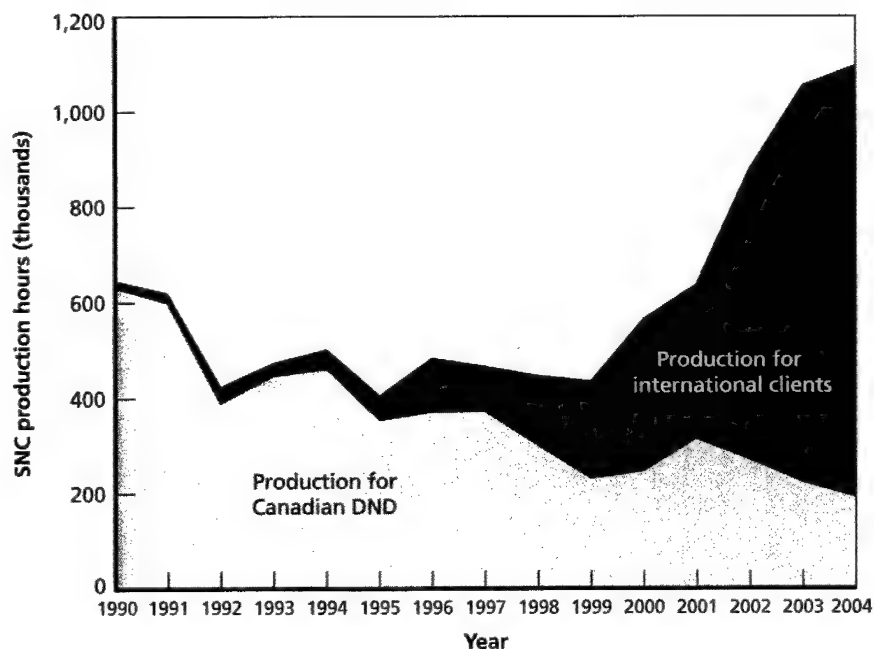
The SNC-Lavalin Annual Report for 2002 shows revenues for its defense programs of CA\$277 million, primarily from the activities of three plants. In addition to the CA\$5 million from the Nicolet test facility, the figure includes about CA\$10 million from its Securiplex fire detection and suppression systems, which is terminating. Hence, the revenues at the three plants would sum to slightly less than the total defense programs figure of CA\$277 million. Therefore, SNC

TEC revenues from DND contracts, including Nicolet and Securiplex, represent about one-third of the firm's total. That fraction is declining as DND buys continue to shrink and international sales grow.

Figure 2.2, which shows the split of SNC TEC production labor hours between DND and its international clients, illustrates both the continuing fall in DND purchases and the continuing growth in international business.

In the early 1990s, virtually all the firm's annual 650,000 production labor hours were devoted to production for DND. As Cana-

Figure 2.2
SNC TEC Ammunition Production Labor Hours Attributed to Domestic and International Customers



SOURCE: Brian Berger, SNC TEC, personal communication, August 14, 2004.

NOTE: Figures for 2003 and 2004 are estimated.

RAND MG169-2.2

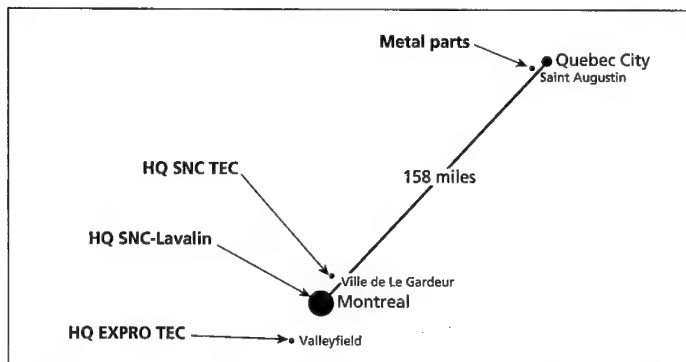
dian government ammunition buys declined, the firm began to substantially increase its international business. That trend continues. By 2001, SNC TEC's total production labor hours had returned to roughly the immediate post-Cold War level of about 650,000 and has since risen to more than one million. In part, the sharp rise beginning in 2002 reflects SNC TEC's acquisition of EXPRO. The firm expects production to continue to climb through 2004, despite a continuing reduction in domestic orders.

SNC TEC sells most of its military ammunition and components to the United States as well as to governments in Europe, Asia, and Australasia. Some of these sales are directly to governments; others, primarily components, go to private firms that in turn sell finished ammunition to their governments.

SNC TEC's Ammunition Manufacturing

Figure 2.3 shows the relative geographic positions of SNC's ammunition manufacturing facilities and headquarters (HQ).

Figure 2.3
Locations of SNC's Ammunition Plants and Headquarters



RAND MG169-2.3

SNC TEC's parent corporation, the Canadian construction and engineering firm SNC-Lavalin, maintains its headquarters in downtown Montreal. SNC TEC owns and operates Canada's three principal military munitions manufacturing sites: the LAP plant at Ville de Le Gardeur, north of Montreal, which also houses SNC TEC headquarters; a metal parts (cartridge case) plant at Saint Augustin, west of Quebec City; and a propellant plant at Valleyfield, 60 kilometers southwest of Montreal, operated by SNC TEC's subsidiary, EXPRO TEC. The Valleyfield site differs from the other two in that SNC TEC does not own the land. Instead, the Quebec provincial government owns the property.⁵ The firm does, however, own the buildings and equipment.

In addition to the manufacturing facilities, SNC TEC operates a government-owned ammunition proofing and testing facility at Nicolet east of the St Lawrence River about halfway between Montreal and Quebec City. No manufacturing is done at this site.⁶ It is a relatively small operation, involving only 35 SNC TEC employees and generating revenues of about CA\$5 million annually.

SNC TEC'S Three Manufacturing Sites

This section provides details about the size, range of capabilities, and current state of each of the three SNC TEC manufacturing sites: the LAP plant at Le Gardeur, the metal parts plant at St Augustin, and the propellant plant at Valleyfield.

Table 2.2 provides a summary comparison of important characteristics of each plant. Le Gardeur and Valleyfield are roughly the

⁵ Chapter Three explains how the province came to acquire the land. EXPRO TEC operates the plant with a 39-year 11-month lease signed in 2001.

⁶ Nicolet is one of four Canadian DND test sites. The other three are the Defence Research Establishment Valcartier near Quebec City, which does research on advanced materials and nanotechnology; the Canadian forces base Gagetown in New Brunswick, which is used for tank, artillery, aircraft, and small arms live firing; and the large training area at Canadian forces base Suffield in Alberta. While SNC TEC operates only Nicolet, it has access to the test facilities at the other three sites, which are all government owned and operated.

Table 2.2
Comparison of Attributes of SNC TEC Manufacturing Sites

Characteristic	Le Gardeur	St Augustin	Valleyfield	Total
Land (acres)	1,037	15	1,112	2,164
Employees	800	175	420	1,295
Building area (thousands of sq. ft.)	946	128	N/A	N/A
Number of buildings	154	3	191	337
Number of magazines	21	0	29	50

SOURCE: All figures are from SNC Technologies, Inc., undated.

NOTE: N/A means not available.

same physical size (about 1,000 acres), but Le Gardeur employs almost 300 more people.⁷ The number of square feet of building space in the 191 buildings at Valleyfield is not available. Further, many of the 191 are derelict and are awaiting razing and removal.

Le Gardeur LAP Plant

The LAP plant at Le Gardeur produces large-, medium-, and small-caliber ammunition, ranging from 155 mm to 5.56 mm. The plant consists of 154 buildings and 21 magazines. All finished ammunition leaves the plant by truck. Manufacturing areas give the appearance of a clean, modern plant. By contrast, with some exceptions, U.S. GOCO plants typically have World War II era equipment and facilities (Hix et al., 2003b, p. 43).

Employing about 800 persons, Le Gardeur is the largest of the three SNC TEC plants. Plant employees average 40 years in age. The labor force is unionized. Shop personnel, office workers, and production personnel are all represented by affiliates of the same union, *Fédération des Travailleurs et Travailleuses du Québec*.

⁷ By comparison, the 11 U.S. government-owned, contractor-operated (GOCO) plants are on average much larger than the Canadian plants. The U.S. plants average 10,000 acres (ranging from 15 to 22,357 acres) in size and about 600 buildings (ranging from 8 to 1,501 buildings) (Hix et al., 2003b, Appendix C).

Lines are reconfigurable to permit rapid changeover across types of ammunition. Some lines can be reconfigured to produce different ammunition within four hours. Runs typically last days to weeks between reconfigurations, and dozens of reconfigurations are typically accomplished on each line each year.⁸ The plant currently has the capability to load, assemble, and pack the more than 90 ammunition items, including the following (SNC Technologies, Inc., undated) (abbreviations are spelled out in the front matter list):

- 155 mm Artillery: HE, Smoke, Illuminating.
- 105 mm Artillery: HE, HE ER, Smoke—2 types, Illuminating, Blank.
- 105 mm Tank: TPFSDS-T, TPDS-T, SRTPDS-T, SH/P-T, Blank.
- 84 mm Recoilless Rifle: HEAT, TP.
- 81 mm Mortar: HE, Illuminating, Smoke, Bedding.
- 76 mm AVGP: HESH, SHP.
- 60 mm Mortar: HE, Illuminating, Smoke WP.
- 57 mm Navy: PFHE, TP, HCER, Non-Fragmentation.
- 35 mm: Break-up, TP-T, HEI, Ahead.
- 25 mm: TPDS-T, APFSDS-T, FAPDS-T, HEI-T, TP-T, Training/Dummy.
- 20 mm: TP—3 types.
- Small Caliber: Caliber 50—8 types, Caliber 45—1 type, Caliber 40—1 type, Caliber 38—2 types, 9 mm—6 types, 7.62 mm—5 types, 5.56 mm—6 types.
- Other: Pyrotechnics—12 types, Demolition—3 types.

The plant is certified as compliant with the International Organization for Standardization, as set forth in ISO 9001-2000. Two Canadian forces quality assurance representatives are stationed permanently at the plant. They act as quality assurance representatives on behalf of other NATO buyers under the provisions of NATO

⁸ By contrast, lines in U.S. plants typically were initially optimized for the longer, larger runs required during World War II and necessary for Cold War production.

Standardization Agreement 4107 (NATO, 2003). The plant began implementing the "Six Sigma" continuous quality improvement program in 2002.⁹

Quality and efficiency improvements have permitted the plant to move from a position of virtually no overseas sales in 1991 to well over half of total sales today. While historical ammunition prices that the government pays SNC TEC are not publicly available, SNC TEC's growing international sales indicate that the firm has made productivity improvements since it bought the plants. Both DND and SNC TEC interviewees report that prices have fallen substantially as a result. Documentation of SNC TEC's actual productivity gains remains proprietary. Such benefits are common, though not universal, in privatizations. An excellent distillation of privatization results in a variety of industries in the United States, Canada, Germany, England, Switzerland, and Japan may be found in Savas (2000).

Le Gardeur produces most of the 120 mm mortar ammunition that the U.S. Army buys today.¹⁰ Interviews with U.S. Army officials at the departmental and program manager level and below revealed satisfaction with SNC TEC as a supplier. Similarly, Canadian government officials report satisfaction with both quality and price of SNC TEC ammunition.

To illustrate recent operations and capabilities, on July 15, 2003, Le Gardeur's area 3B3, a flexible line, was assembling M74 105 mm tank training rounds (SRTPDS-T). The line can be reconfigured in a matter of hours to LAP 84 mm; 57 mm Navy rounds; 60 mm, 81 mm, or 120 mm mortar rounds; or 105 mm artillery rounds. The line has a capacity of 500 105 mm tank rounds per shift. Each shift employs 12 personnel. Many of the components for the tank training and other rounds come from other SNC TEC plants. For example,

⁹ For basic information on Six Sigma, its history, and philosophy, see iSixSigma LLC, 2003.

¹⁰ Le Gardeur does not load, assemble, and pack 120 mm smoke and illumination rounds for the U.S. Army. Pine Bluff Arsenal produces those items.

Valleyfield supplies the propellant, and cartridge cases come from SNC TEC's St Augustin plant.

In area 3B1, SNC TEC loads, assembles, and packs 105 mm extended range artillery projectiles and 120 mm mortar rounds. On July 15, 2003, the line was assembling 120 mm M934A1 mortar rounds. Two U.S. firms, KDI and Lockheed Martin, provide the fuzes and fins, respectively, for the mortar rounds. A third U.S. firm, Day and Zimmerman, provides the propelling charges, which are made at two U.S. GOCO plants—Iowa and Kansas army ammunition plants (AAPs).

The plant also melts and pours high explosives (HEs) to fill the large-caliber rounds it produces. The plant manager, Émile Laroche, describes with pride the plant's unique processes for cooling and quality control of the HE-filled projectiles. SNC TEC's development of these melt-pour processes was instrumental in its winning the U.S. mortar contracts. According to the U.S. Army's Office of the Program Manager for Mortars, the U.S. Army GOCO plant at Milan, Tennessee, had been unable to solve related quality problems for several years before SNC TEC won the mortar contracts (U.S. Department of the Army, 2000). For U.S. contracts, the U.S. government provides SNC TEC composition-B explosives as government-furnished materiel from the U.S. Army GOCO plant at Holston, Tennessee. SNC TEC also buys composition B for other contracts.

Le Gardeur's area 2D22 is SNC TEC's small-caliber LAP facility. Much of the small-caliber equipment is of French origin. A growing part of SNC TEC's small-caliber LAP is devoted to its SIMUNITION® product line. SIMUNITION products consist of three types of reduced-energy, small-caliber training rounds. One type, used in force-on-force training for law enforcement agencies and military special operations forces, marks targets with variously colored marking compounds. The other two reduced-energy rounds consist of a safe, nonlethal blank and a lethal target practice round. Two types of frangible, nontoxic but lethal, full-energy rounds complete the SIMUNITION line.

The Saint Augustin Metal Parts Plant

CAL opened the St Augustin plant, west of Quebec City, in 1984. This clean, modern facility, consisting of three buildings on 15 acres, manufactures a wide array of metal parts for ammunition from small to large caliber. Specifically, the plant has the current capability to make the following cartridge cases: 105 mm howitzer blank, 105 mm howitzer, 105 mm tank, 90 mm tank, 76 mm tank, 57 mm and 3"/50 caliber naval cartridge cases, and an array of small-caliber cases, from 5.56 mm to 20 mm. St Augustin's computer numerically controlled machine shop makes other metal parts, mostly from steel, but it also makes magnesium sabots.

The St Augustin plant uses Belgian technology and German equipment originally bought by CAL. When the plant was opened, it consisted of the building that now houses the large-caliber cartridge case production. After The SNC Group bought CAL in 1986, it purchased a building nearby to house the small-caliber metal parts production lines that were moved from another plant formerly owned by Industries Valcartier, Inc. (IVI). That plant was shut down in 1991.

In 1984, when the St Augustin plant was first opened, it cost CAL CA\$500,000 and took a year to develop a capability to manufacture metal parts for a new round. The original goal was to shorten the development time to nine months; SNC TEC now has it down to six. It takes only one–two months to modify an existing round. The most troublesome task is getting the tooling for large-caliber cartridges. It may take more than one try to perfect the tooling. It is also sometimes a problem getting satisfactory raw materials, usually a disk, cup, or strip of brass.

Valleyfield Propellant Plant

The Valleyfield propellant plant dates to 1941, when the government built it to be operated as a government-owned facility. After the war, the government folded it into the newly created crown corporation, CAL. It was privatized in 1965 and acquired by SNC TEC in 2001, following the bankruptcy of its previous owner. Valleyfield develops and manufactures energetic material for military, sporting, and automotive (air bag) applications. It is one of two remaining propellant

plants in North America, the other being the U.S. Army GOCO plant in Radford, Virginia.

The generally run-down appearance of Valleyfield reflects its age and a lack of investment by a series of private owners after the plant's 1965 privatization. SNC TEC and the Canadian government are funding a major multiyear investment program in the plant's infrastructure, with emphasis first on safety and secondarily on productivity, quality, and environmental concerns. For example, EXPRO TEC has just renovated a large brick building, once used in part as a power plant, to house its headquarters and other administrative functions. Other capital projects are under way.

Roughly 75 percent of the plant's revenues come from its military propellant production, whose primary customers are the governments of Canada and the United States, as well as those of several European nations. Sporting ammunition propellants make up another 20 percent, principally to U.S. customers. The final 5 percent represents gas generators for automotive air bags, sold principally to U.S. and Japanese manufacturers, a growing market segment.

Table 2.3 shows EXPRO TEC's principal military propellant production by customer.

Table 2.3
Current Production Levels at Valleyfield

Product	Customer and Nation	Annual Production (millions of pounds)
M30A2 arty (MACS)	U.S. Army ARDEC, U.S.	3.0
M14 tank training	GD-OTS, U.S.	2.5
M1, M6 arty	DND, Canada	0.6–0.8
11R9 tank	MECAR, SA, Belgium	0.3–0.4

SOURCE: SNC Technologies, Inc., 2003.

NOTE: See the abbreviations list for definitions.

Triple-base M30A2 granular propellant¹¹ for use in the M232 propelling charge for the U.S. Army's Modular Artillery Charge System (MACS) represents the largest single program at an annual three million pounds of propellant. The next largest program is M14 tank training ammunition propellant sold to General Dynamics—Ordnance and Tactical Systems (GD-OTS) for ammunition assembled at the U.S. Army's Iowa plant. Production is about 2.5 million pounds. By contrast, the plant sells less than a million pounds to the Canadian DND. Most Valleyfield production is exported to the United States. The total military production is slightly more than CA\$50 million. SNC TEC regards the specific revenues associated with each product as proprietary. Hence, they are omitted from the above table.

¹¹ The term "triple base" means that the propellant has three major ingredients. In the case of M30A2, the propellant consists of 30 percent nitrocellulose, 20 percent nitroglycerine, and 50 percent nitroguanidine. Other propellants may be double or single base, the most common at Valleyfield being the single-base M14 tank training ammunition propellant.

Creation and Transformation of the Canadian Ammunition Industrial Base

This chapter traces the several steps in the 19th and early 20th century development of Canada's munitions industrial base and its transformation after World War II from government ownership to the privatized base that exists today.

Until the complete privatization of its base in the latter half of the 20th century, Canada relied on a mix of government and private arms manufacturing.¹ The signal events in the history are the privatizations that occurred between 1965 and 1986, severing Canada's century-old policy of government ownership of at least part of its ammunition base.

Development of the Government-Owned Ammunition Industry

Until the late 1860s, Canada, having few industrial resources and little interest in supporting a substantial defense force, relied on England for both troops and arms.² Shortly after the federation of four provinces into the Dominion of Canada in 1867, England withdrew its troops from the Dominion, leaving more than 40,000 Snider En-

¹ For a history of the development of the U.S. arms industrial base see Hix et al., 2003b, Chapter Two. Both nations have traditionally relied on a mix of private and government ownership of plants to meet their requirements.

² The pre-World War II history related here comes principally from Haycock, 1988, pp. 71-94.

field breech loading rifles with ammunition. This stock met Canada's immediate military needs. The nation also had the ability to supplement these stocks from England or the United States. Hence, the fledgling nation had no urgent need to concern itself with an arms industrial base.

But by the late 1870s, three factors led the government to begin to plan for domestic manufacture of arms and ammunition. First, technological change began to render the Enfields obsolete. Second, in the late 1870s the Dominion became concerned about possible Russian incursions in the west. Finally, during this period British arsenals became overcommitted supporting imperial activities overseas, making them less able to meet possible Canadian needs. As a result, Canada began considering how best to build a domestic arms capability. It decided to pattern its arsenal after England's government-owned Royal Arsenals, which dated to 1560. Only a government-owned solution was feasible at the time; no private firms were interested in building plants to meet the government's tiny military requirements.³ Hence, the public-sector solution resulted less from a philosophical preference for government ownership than from practical considerations.

In 1880, the cabinet approved the building of a government arsenal system, and in 1881 the Government Cartridge Factory was opened in Quebec City with 25 employees. The arsenal began by making cartridges for small arms, importing most of the components (gunpowder, brass, lead, and primer) from England. In 1887, the plant added artillery shells to its production, but it still fell short of the complete arsenal some had envisioned; it made no small arms or artillery pieces, only ammunition. A complete arsenal system would have been too expensive and risked drawing the Dominion into supporting British imperial affairs, a politically sensitive issue in Canada.

³ Canadian industry was nascent at the time. One might argue that if the government had been willing to pay the high overhead for an underutilized civilian facility, some firm might have responded. Nevertheless, the government chose not to try to entice private manufacturing but instead became the manufacturer of last resort.

It wasn't until the Boer War at the turn of the century that quality and schedule problems at English factories forced the Canadian government to expand its domestic capabilities to include the manufacture of arms. But instead of adding arms manufacturing to its government-owned arsenal, it turned to Scottish entrepreneur Sir Charles Ross, who gained government support to build a private factory to manufacture and sell his Ross rifle. Ross's plan was to recoup his investment principally through international sales to other governments within the British Empire and sales of a sporting model of his weapon, while meeting the modest needs of the government. Government orders alone would not have justified the investment in either a government or a private plant. The government subsidized Ross's plant through highly discounted rents it charged for use of a government building in Quebec City, through credit advances, and through rebates and by supporting artificially high prices for the weapons Ross manufactured. The plant became highly politicized. During World War I, Ross began to encounter quality problems and had trouble meeting schedule commitments. In 1916, the Ross rifle was withdrawn from service, and English plants supplied rifles to Canada for the remainder of the war. The Ross plant closed in 1917.

In the meantime, the government arsenal in Quebec City was renamed "Dominion Arsenal" in 1900 and continued to produce ammunition under that name through World War II and until it became the Dominion Arsenal Division of CAL in 1947.⁴

During the latter part of the 19th century, Dominion Arsenal's ammunition-producing equipment and processes had become obsolete through lack of demand and a lack of government interest. During World War I, the Dominion Arsenal plants—in Lindsay, Ontario, and Quebec City—contributed in only minor ways. The government relied instead on newly built government and private plants (such as the Ross plant) to meet the increased demand. After the war, these newer facilities were closed and dismantled, but the government-owned Dominion Arsenal plants remained, relying in

⁴ Information on the history of Dominion Arsenal comes from *Quebec Arsenal*, 1947, pp. 21, 92; *Government of Canada*, 1967, p. 9; and *Government of Quebec*, 2002.

the interwar years principally on small U.S. contracts for survival. Several times before the depression, the arsenal shut down entirely for lack of orders. During this period, the small government demand attracted no private interest in ammunition manufacturing. For the same reason, Dominion Arsenal was not modernized.

By 1936 only two munitions-related producers were operating in Canada, the government's Dominion Arsenal and the privately held Canadian Industries Limited (CIL), which manufactured the smokeless propellant cordite. In the late 1930s, Canada decided that, should expansion for a major war be necessary, it would rely primarily on government-owned facilities. To do otherwise, it was felt, would have risked profiteering, patronage, competition with British firms, and, most important, its neutrality. Further, the DND preferred to use government-controlled arsenals. Yet in the end, in part for ease and speed of establishment, Canada ended up relying to a large extent on private rather than government production to meet its World War II needs. The government contracted only with established, trusted firms such as CIL, National Steel Car Company, and John Inglis Company of Toronto.

But expansion of private manufacturing was complemented by a substantial expansion of government arms and ammunition. In the early years of the war, when industry in England was under the constant threat of attack by the German Luftwaffe and the danger of a German invasion of the British Isles was real, the Canadian government built other plants, primarily in the province of Quebec, to ensure that an ammunition industrial base would be available for the fight against Nazi Germany. In 1938, the government completed a small-caliber ammunition facility, called the Val Rose plant, in Valcartier near Quebec City. It became an extension of the government-owned Dominion Arsenal, permitting Dominion's 1880-era Louise Basin plant in Quebec City to focus on the production of large-caliber metal parts. In 1941, two other facilities that remain to this day were also built: the large-caliber LAP facility at Le Gardeur and the energetic materials production plant in Valleyfield. Design of the new facilities and of the equipment in them was based primarily on existing ammunition facilities in Great Britain. Peak World War II

employment at the various plants was as follows: Le Gardeur—14,000, Valleyfield—4,000, and Dominion Arsenal—14,000.⁵ Collectively, the plants provided a significant portion of the ammunition used by the allies in World War II.

After the war, on September 20, 1945, about a dozen of the government-owned plants were incorporated by letters of patent under Section 181 of the Canada Business Corporation Act as a wholly government-owned⁶ crown corporation called Canadian Arsenals Limited. Crown corporations offer the advantage of eliminating manufacturing from the set of competencies required of government agencies.

Crown corporations are analogous to federal government corporations (FGCs) in the United States. Like FGCs, crown corporations are organized and operated to execute national policy. In this case, the Canadian government's policy of ensuring a domestic industrial capability for the manufacture of ammunition was initially implemented through the existence of CAL. Employees of crown corporations and FGCs are not government employees, but they enjoy some of the same compensation benefits as government employees. Additionally, the laws and regulations specific to the operations of government organizations do not usually apply to crown corporations. As a result, crown corporations and FGCs operate much more like commercial-sector businesses than wholly government operations can. Thus, when implementation of a national policy requires the conduct of "commercial-like" activities, a crown corporation may be established with the expectation that it will operate more efficiently and flexibly than a purely government operation. Nevertheless, the government may either implicitly or explicitly guarantee the credit of crown corporations and FGCs, or it may provide them subsidies or protect them from competition. Hence, they typically do not face the same incentives for efficient production as private-sector corporations

⁵ Source of Le Gardeur and Valleyfield numbers is André Breton, Vice President and General Manager, EXPRO TEC. Source of the Dominion Arsenal number is Quebec Arsenal, 1947, p. 92.

⁶ At the time of incorporation, DSS was the sole shareholder.

functioning in competitive markets. Indeed, the lack of competitive market conditions often serves as the justification for establishing and continuing these quasi-government entities.

When founded, CAL manufactured both ammunition and other ordnance materiel, including small arms, instrumentation, and radar. As late as 1960, CAL still owned and operated ten World War II era plants and two storage depots, parsed among the six divisions Table 3.1 shows.

In 1963, CAL ceased production at its Gun Ammunition Division in Lindsay, Ontario, transferring the equipment, tooling, supplies, and data to other divisions and selling the plant to be used for civil purposes. Recognizing the ability of the private sector to manu-

Table 3.1
CAL Divisions and Plants in 1960

Division and Plant	Location	Mission
Dominion Arsenal Division Palace Hill	Quebec City Quebec City	Artillery cartridge cases, clips, and links
Louise Basin	Quebec City	Artillery cartridge cases
Val Rose	Quebec City	Small arms ammunition
Gun Ammunition Division	Lindsay, Ont.	Components and assemblies for 20 mm to 5.5"
Small Arms Division	Long Branch, Ont.	Small arms, machine guns, repair of recoil mechanisms
Filling Division	Le Gardeur, Que.	LAP artillery, mines, bombs, grenades, torpedoes, depth charges, rockets, and initia- tors
Explosives Division	Valleyfield, Que.	Energetic materials
De Salaberry	Valleyfield, Que.	Hexachloroethane
Shawinigan Falls	Shawinigan Falls, Que.	Gun and fuze powder
Beloeil	Beloeil, Que.	Explosives storage
St Dominique Depot	St Dominique, Que.	Process equipment storage
Nobel Depot	Nobel, Ont.	
Instrument and Radar	Scarborough, Ont.	Electronic, optical, and fire- control equipment

SOURCE: CAL, 1960, pages unnumbered.

facture high-quality instrumentation and electronics, in 1964 CAL closed its Instrument and Electronics Division (formerly, Instrument and Radar Division) in Scarborough, Ontario. In 1965, the Palace Hill plant was closed and its equipment transferred to the Louise Basin plant. The plant itself was turned over to the Crown Assets Disposal Corporation for sale of land and buildings. One of the two storage depots was closed in 1964; the other, along with the Shawinigan Falls and Beloeil plants, was declared excess in 1965. These closures differed from the privatizations of the 1960s and in 1986 (described below) in which CAL sold plants to private owners as going concerns with agreements for the new owners to continue to produce ammunition for DND.⁷

The consolidations and divestitures of the early 1960s left CAL with four divisions: Dominion Arsenal Division, consisting of two plants, Louise Basin and Val Rose; Small Arms Division, with one plant in Long Branch, Ontario; Filling Division, with its Le Gardeur plant; and the Explosives Division, now with only its plant at Valleyfield. Hence, in a period of only two years, CAL had streamlined itself from an operation consisting of ten plants and two depots to one of only five plants—all still owned by the crown corporation.

The First Wave of Privatization in the 1960s

During 1964, CAL conducted studies to “determine whether certain of the Company’s Divisions should be sold to industry in order to provide a greater scope for their manufacturing potential, while protecting the military function for which they were designed”(CAL, 1965). Although this precursor study did not lead to an immediate government plan to privatize CAL’s plants, it did open the government to private-sector overtures to buy some of them.

The first ammunition facility to be sold as a going concern to a private company was the energetic materials plant at Valleyfield,

⁷ The information in this paragraph comes from CAL, 1960–1966.

Quebec. CIL, a subsidiary of the international firm Imperial Chemical Industries approached the government about buying the Valleyfield plant and consummated the deal in 1965. It did so with the expectation that it would operate the plant for approximately ten years, after which it planned to close it. As a result, CIL made little investment in modernizing the plant's World War II-vintage operations. Despite the importance of the plant to the nation, the Canadian government took no steps to separately fund plant modernization.

While CIL did dispose of the plant ten years after it was purchased, the facility was not closed. Instead, in 1975 Dr. Jerry Bull, a scientist and entrepreneur with plans to develop cannon-launch systems for satellites, bought the Valleyfield facility and formed Valleyfield Chemical Products (VCP) to manage operations. Unfortunately, VCP was not successful and went bankrupt six years later. Eventually, two businessmen, Eric Brooks and Farouk Dawood, agreed to buy the facility and became the new owners in 1983. Shortly after the purchase, the Valleyfield energetic materials plant was renamed EXPRO, the name by which the facility is still familiarly known. Subsequent developments at EXPRO are described in a section below, dealing with CAL's eventual purchase of the plant.

The second facility to be privatized was the small arms ammunition plant Val Rose, one of two remaining plants in the Dominion Arsenal Division of CAL. In 1967, a group of investors saw potential commercial value in that facility and made an unsolicited, but successful, offer to the government to buy it. CAL divested itself of the Val Rose operation, and IVI was incorporated to operate the facility, which it did until 1980 when The SNC Group bought it. SNC operated the plant until 1991, when it closed the facility and split the production between its Le Gardeur and St Augustin plants, with the small arms LAP going to Le Gardeur and the cartridge case operation transferring to St Augustin.

In 1968, Louise Basin, the large-caliber cartridge case plant in Quebec City and the last of CAL's three Dominion Arsenal plants,

was privatized when, like Val Rose, it was also sold to IVI.⁸ The 1960s privatization of Valleyfield, Val Rose, and Louise Basin left CAL with two divisions of one plant each, the Filling Division at Le Gardeur and the Small Arms Division at Long Branch, Ontario.

Decline of Ammunition Manufacturing and the Development of an Industrial Base Policy

Before 1978, the government of Canada had no overarching industrial base policy for ammunition. Government ownership of ammunition and ordnance-related plants had given way to some privatization but not as part of any specific plan. The government was obviously becoming more comfortable with and reliant on private-sector manufacturing. DND and DSS pursued competitive contracting for ammunition and awarded contracts based on lowest initial cost (Government of Canada, 1988, Chapter 15). By the mid-1970s, the munitions industry was in financial difficulty because of the changing types and quantities of ammunition required by DND from year to year and a lack of export opportunities. Neither the industry nor DND was providing funds to upgrade and modernize production facilities.

In 1978, the Canadian government decided as a matter of national policy that it should maintain domestic sources of supply for ammunition, since in times of conflict foreign ammunition producers were considered likely to divert production from exports to their own national requirements and might not be inclined to adapt their products to meet Canadian specifications. The document setting forth this policy, the Munitions Supply Program (MSP), designated six Canadian companies as “preferred suppliers” for specific types of ammuni-

⁸ CAL sold the buildings and equipment to IVI, but the land remained property of the federal government, specifically the Old Quebec Port Society (email from André Breton, October 13, 2003).

tion being procured at the time.⁹ The firms, with their locations and preferred products, were:

- Bristol Aerospace/Winnipeg, Manitoba—rockets
- Diemaco/Kitchener, Ontario—small-arms weapons
- IMT/Ingersoll, Ontario—projectile forgings
- CAL/Le Gardeur, Quebec—large-caliber LAP
- VCP/Valleyfield, Quebec—energetic materials
- IVI/Valcartier, Quebec—small-caliber ammo.

Under the “preferred supplier” relationship, the Canadian government can decide to compete ammunition contracts if the prices charged by the Canadian firms are not competitive with those of foreign suppliers, but it does not require any justification other than the MSP to treat the Canadian firms as sole sources.

The MSP does not cite specific types of ammunition to be included in its “preferred supplier” arrangement. Those are laid out in ten-year so-called “settlement agreements,” which specify types of ammunition to be included for the next ten years.¹⁰ The settlement agreement is supplemented by annual negotiations, which lead to annual “global agreements” that specify quantities and prices for the coming year.

In practice, the Canadian government has rarely competed contracts for the large-consumption ammunition types specified in the settlement agreements, although it buys some items needed in small quantities from producers in other countries that have larger production runs.¹¹ In return, the Canadian preferred suppliers are required

⁹ The MSP itself is restricted. Since its approval in 1978, the document has not been updated, though much has changed since its drafting. Details of the purpose and workings of the MSP may be found in Government of Canada, 1988, paragraphs 15.21–15.40. During several interviews, current and former government officials, as well as officers of SNC TEC, amplified and verified the information contained in that report.

¹⁰ The most recent settlement agreement was published in 1996. Planning for the next one is under way as of this writing.

¹¹ Contracts for new types of ammunition not included in the settlement agreement are generally competed for or are sole-sourced, either internationally or in Canada.

to maintain and modernize capacity to meet present and future ammunition requirements of the Canadian forces; give priority to Canadian contracts over export production; meet DND's technical, quality, and schedule requirements; use Canadian inputs to the maximum extent possible; maintain a research and development (R&D) capacity; and charge fair and reasonable prices to the Canadian government.

Importantly, the MSP does not guarantee the continued operation of any of the facilities listed. Nevertheless, listing in the MSP has indicated strong government interest in the continued vitality of the identified industries.¹²

Preparing CAL for Privatization

After the divestitures and consolidations of the 1960s, CAL continued to operate the large-caliber LAP facility at Le Gardeur and the small-caliber weapons facility in Long Branch, Ontario, until the latter was closed in 1976 and its manufacturing transferred to the private sector. In the spring of 1977, CAL commissioned a study to determine what was required to ensure the long-term health of its remaining operation at Le Gardeur. CAL had lost money every year since 1969. During the period 1970–78, CAL had total revenues of \$53.2 million, yet the government invested only a total of \$2.8 million in capital improvements during those nine years (CAL, 1969–1978).

The study made a number of major recommendations including the expansion of domestic and export sales, appointing a new board of directors, and making CAL the prime contractor for all Canadian

¹² For example, this interest has resulted in sustained government support for the Valleyfield energetic materials plant. Over the course of Valleyfield's operations, the Canadian government has provided substantial financial support to the facility, in addition to its strong role as a customer of the plant's products. The financial support has included grants of money, loans, and, in the case of the 1982 bankruptcy, active involvement in the maintenance of continued operations and the identification of new owners.

ammunition.¹³ While the government's thinking in the late 1970s was clearly aimed at maintaining domestic sources of supply, it also foresaw greater reliance on the private sector for that domestic supply. After the study, but a year before the MSP was approved in 1978, CAL's board of directors was given a mandate to convert the crown corporation into a commercially viable operation capable of attracting private-sector capital.

CAL began implementing these policies in 1978. New management was hired to run the company and the entire board of directors was replaced.¹⁴ Both the 1978 and 1979 CAL annual reports mention the objective of creating a commercially viable business capable of attracting investments from the private sector. Beginning in 1980, CAL was required to finance its own capital investments, which DSS had previously funded separately. Hence, the Canadian government had a clear intent to transform CAL into a more commercial-like business, with the eventual goal of privatizing the crown corporation in some manner.¹⁵

The government also contributed to CAL's transformation by identifying it as the Canadian prime contractor for large-caliber ammunition. From that point forward, rather than making "break-out" contracts for component manufacture and final LAP, the government began contracting with CAL for production of entire end items. This change contributed to the dramatic increase in revenues from the Le

¹³ Up until this time, the Canadian government's DSS had acted as a "pseudo" prime contractor for ammunition, managing the specifications and configuration control of the end items and all of the component parts. The government had also let separate contracts to produce the various components for each large-caliber ammunition type it was purchasing. These were provided to CAL as government-furnished materiel. CAL had a LAP contract only.

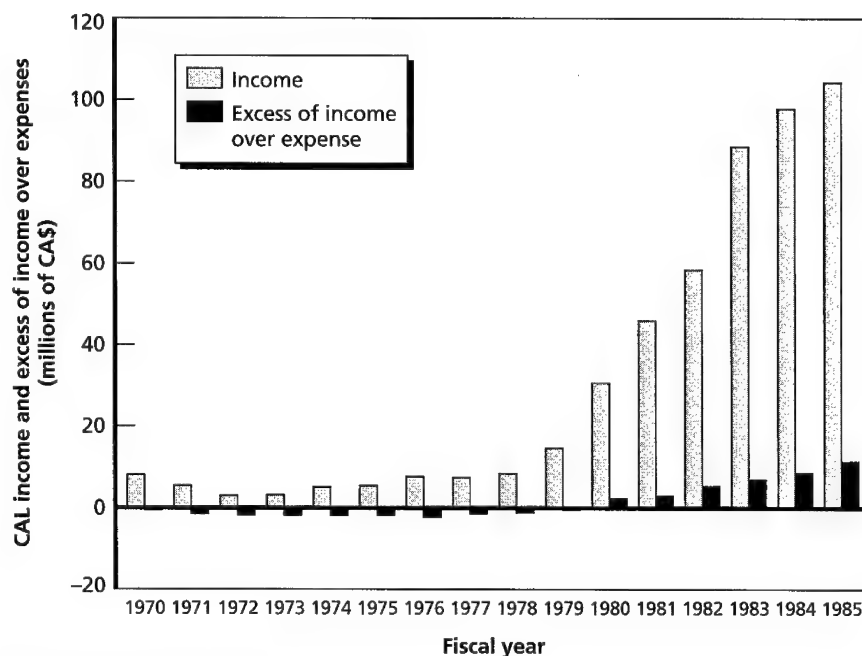
¹⁴ See list of corporate officers in the following two documents: CAL, 1977, p. 3, and CAL, 1978, p. 3. The 1977 report lists five directors; the 1978 report lists six, all new. Further, all the officers were replaced, and the corporate headquarters was moved from Ottawa to the plant location at Ville de Le Gardeur. Even the general counsel was replaced—a clean sweep of management.

¹⁵ Claude Tasse, who worked at Le Gardeur at the time, recalls that the government attempted to sell the plant in 1979 but found no takers. The small business base made the plant unattractive to potential buyers (personal communication, September 18, 2003).

Gardeur plant after 1979 (see Figure 3.1). The money the government previously spent directly on the production of ammunition components now flowed through CAL to the component suppliers. Former government-furnished materiel now showed as CAL income.

But CAL's growth in revenue between 1979 and 1985 is attributable to more than the change to prime contracting. During the same period, the Canadian government began substantially increasing the amount of ammunition it bought. These changes also improved

Figure 3.1
CAL Income and Excess of Income over Expense, 1970–1985



SOURCE: CAL, 1971–1986.

RAND MG169-3.1

CAL's excess of income-over-expense picture.¹⁶ As Figure 3.1 shows, CAL lost money until 1979, then steadily increased its excess of income over expense in each succeeding year to CA\$11.3 million in 1985, its last year before privatization. These financial improvements made CAL a much more attractive privatization candidate.

The policy change to prime contracting took effect in 1979, but the revenue increases took several years to build, because there was only a small business base at the outset and contracts were converted over a period of several years. For example, the first large contract, for several hundred thousand 105 mm HE rounds, was spread over four to five years and also required some investment and reorganization to accommodate. The growth in revenues was due not only to the change to prime contracting but also to a purposeful increase in government purchases from the plant.¹⁷

A final contributor to CAL's growth in revenues was its successful bid to manufacture large-caliber cartridge cases. These products had been produced by IVI at its Louise Basin plant since the plant's 1968 privatization. In 1980, the government decided to stop buying from the outmoded plant. It invited IVI and CAL to bid on building a new plant to continue manufacturing large-caliber metal parts. CAL won the competition and built the plant at St Augustin, just west of Quebec City, completing it in 1984 at a cost of CA\$13 million.¹⁸ The federal government paid IVI to demolish the buildings at the Louise Basin plant and remove the equipment from the site. The government turned the land over to the Old Quebec Port Society, a government agency that still holds the land.¹⁹ CAL's winning the

¹⁶ Not-for-profit firms such as CAL by definition do not have profits and losses. Instead, the accounting convention is to speak of excesses of income over expenses, or the converse. During CAL's existence, the government made up for CAL losses by authorizing funds through separate votes of Parliament. Similarly, CAL typically returned excesses of income over expenses to the Receiver General.

¹⁷ Claude Tasse, personal communication, September 18, 2003.

¹⁸ CAL, 1984 and 1985.

¹⁹ Details of the Louise Basin closing were provided by André Breton (email, October 13, 2003).

competition had the effect of moving workload from the private Louise Basin plant to one owned by the crown-corporation CAL for another two years until CAL was itself privatized. This workload acquisition added to the revenues of the crown corporation in its last two years, helping push revenues over the CA\$100 million mark.

Eight years earlier, it had been less than one-tenth that figure. A prospective buyer of the CAL in 1986 would have observed phenomenal growth both in revenues and an accompanying increase in profits for a sustained six-year period. This was not lost on The SNC Group and other bidders. The next section traces how SNC came to purchase CAL and became the Canadian government's dominant provider of ammunition.

SNC Becomes Canada's Principal Ammunition Supplier

In the late 1970s, The SNC Group was a medium-sized, closely held engineering firm whose primary business was the management of large capital projects.²⁰ While the firm was successful, its primary business was vulnerable to the business cycle, which was entering into recession. As a result, The SNC Group board of directors wished to diversify into a more stable business area that was less a captive of the business cycle. At the time, the owner of IVI, R. Guy Godbout,²¹ sat on SNC's board and suggested that he sell IVI to SNC. The small-arms ammunition business relied on military sales, both export and domestic, for a majority of its business, and that market tended to be relatively stable.²² In addition, the military business was conducted on a "cost-plus" basis, so profits were shielded to a large extent from competitive cost pressures. In 1980, the SNC board agreed to purchase IVI for CA\$7 million in cash (financed through bank borrow-

²⁰ This section provides an overview of the key events in SNC's growth into ammunition manufacturing. A more detailed history of The SNC Group is provided in Appendix A.

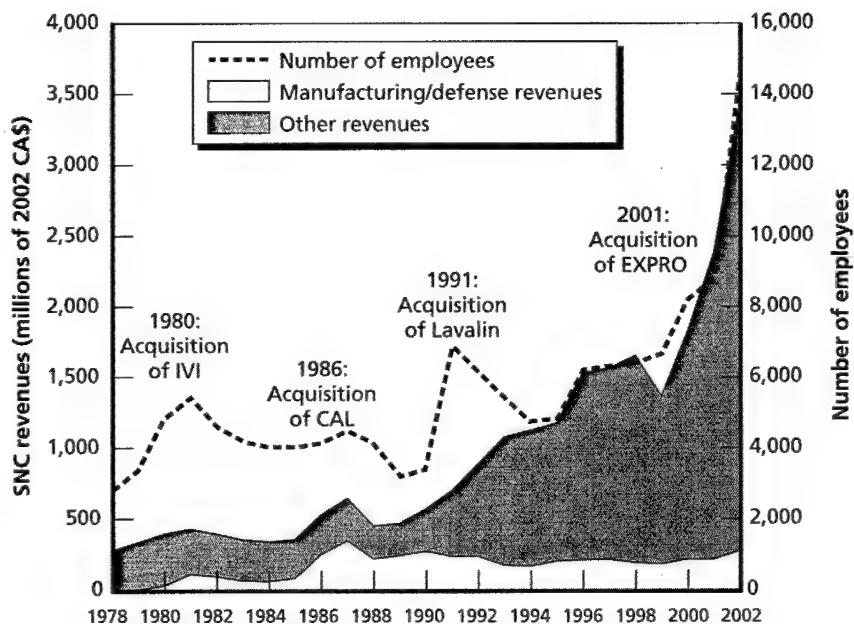
²¹ Guy Godbout was the owner of the investment company Gestion Prego Inc., which held the interest in IVI.

²² IVI also made sporting ammunition for commercial markets.

ing). It also assumed CA\$8.5 million in liabilities.²³ SNC paid off the debt over the next several years with profits from its newly acquired small-caliber ammunition facility. SNC's revenues from ammunition and other businesses and total number of employees from 1978 through 2002 are shown in Figure 3.2.

As expected, the small-caliber ammunition business was both stable and profitable. In 1981 and 1982, annual ammunition revenues were approximately CA\$50 million (see Table A.1 in Appendix

Figure 3.2
SNC Revenues and Total Employment, 1978–2002



RAND MG169-3.2

²³ As part of the sale transaction, the cash payment could be increased depending on the performance of IVI through March 31, 1983 (The SNC Group, 1981, p. 25). Based on IVI's successful operating results, SNC paid an additional CA\$2,406,000 in 1983 (The SNC Group, 1983, p. 12).

A) and its gross margin was CA\$10–12 million (in then-year dollars) (The SNC Group, 1982 and 1983). As a result, SNC saw an advantage to expanding its military ammunition business and hired a consulting firm, CFN Consultants, to look into the potential for acquiring CAL. As mentioned, the government too had been considering privatizing CAL. As early as 1974, DSS set up a task force to consider further privatization of CAL. These efforts eventually ended with the 1978 decision to keep CAL a crown corporation, but the serious consideration the government gave to privatization and the interest SNC began to develop in the early 1980s concerning the acquisition of CAL provided the environment that eventually resulted in the sale of CAL.

Shortly after the 1984 election of a conservative government, a somewhat informal privatization unit was established under the Minister of the Treasury Board. The unit was responsible for drafting the government's privatization policy and assessing which crown corporation holdings no longer had a public policy function.²⁴ The prime minister's office desired to start the privatization era with small but easily successful pilot cases. CAL itself was relatively small, and it serviced a small but stable market, so in the spring of 1985 the cabinet-level Privatization Committee approved the sale of CAL. Since the privatization unit was not intended to be involved in executing policy, implementation of the CAL privatization was passed to DSS, which acted as CAL's sole shareholder at the time.

DSS initiated the CAL sale by sending letters informing selected potential purchasers of the government's intent to privatize the last remaining division of CAL. This was not an open solicitation. DSS officials had a good understanding of the industry and selected potential buyers based on their assessment of whether they would be able to manage CAL's operations. Five companies²⁵ eventually responded,

²⁴ In 1986, privatization became more centralized and formal. A Minister of State (Privatization) was made responsible for this activity, and the Office of Privatization and Regulatory Affairs was established to support privatization efforts. See Nakani, 1988.

²⁵ One company not sent the initial letter learned of the situation and responded with a last-minute bid.

and, after three stages of bidding,²⁶ The SNC Group won the right to acquire CAL. The sale was completed in May of 1986 for CA\$92 million (Nakani, 1988).²⁷ In addition, the government settled the accrued pension liability for CAL employees by placing CA\$26 million into the SNC pension fund. Settling the accrued pension liability was considered an important potential sticking point. Both sides in the negotiation believed fair treatment of former CAL employees to be essential to consummating the deal.

In return, SNC was required to maintain the capability to manufacture the current line of CAL products, but the government also committed to buying those products from SNC for ten years. To finance the sale, SNC sold shares to the public for the first time. It had previously been an employee-owned firm.

At the conclusion of the sale, The SNC Group owned and operated three ammunition-related facilities through a subsidiary created for that purpose, SNC Defence Products Limited.²⁸ These three facilities were the large-caliber LAP plant at Le Gardeur, the small-caliber ammunition facility at Valcartier, and the large-caliber cartridge-case facility at St Augustin. From 1986 through 1990, ammunition and other defense products represented about half of The SNC Group's revenues and helped offset losses in the group's other businesses, particularly in 1987 and 1988.

A combination of the defense buildup of the 1980s and a cost-plus contracting environment made The SNC Group's moves into the defense market appear to be savvy acquisitions.²⁹ Unfortunately

²⁶ DSS had hired the accounting firm Arthur Anderson to value CAL prior to the auction and so had a reasonable idea of its worth.

²⁷ Hix et al., 2003b, estimated the value of the U.S. plants discussed in their report using several methods with varying assumptions. As a test of the methodologies, Appendix C applies them to CAL at the time of its privatization. All estimates proved to be conservative in that they underestimated the value of CAL relative to its actual selling price.

²⁸ Since that time, SNC Defence Products Limited has changed its name twice: first in 1991 to SNC Industrial Technologies Inc. and finally in 1999 to SNC Technologies, Inc.

²⁹ Contracting terms are discussed in greater detail elsewhere in this report. For the purposes of this section, cost-plus contracting refers to price setting based on an agreed upon allocation of all the costs of production plus some level of profits as a percentage of costs. Cost-

for SNC, the Canadian government's ammunition requirements declined substantially as the Cold War drew to a close at the end of the 1980s. SNC's ammunition revenues peaked in 1987, and the Canadian government announced a further 40 percent reduction in annual requirements in 1991 (The SNC Group Inc., 1992). This change in its defense market had a number of consequences: consolidation of ammunition production operations, a lawsuit against the government, and a change to a fixed-price contracting strategy.

In 1989, SNC Defence Products began to study consolidation options. The company initially considered closing the Le Gardeur facility and moving those LAP operations to Valcartier and St Augustin because of the potential value of the suburban Montreal land at Le Gardeur for residential development. This move turned out to be impractical, however, because of the substantial estimated cost to clean up environmental hazards at Le Gardeur to residential standards. Additional study in 1990 revealed that it would cost about CA\$25 million to move the Valcartier operations, alternatively, to Le Gardeur and St Augustin.³⁰ The government approved the proposed move and agreed to hold ammunition prices constant for the three years following the move so that the firm could finance the consolidation from expected savings. In 1991, SNC Industrial Technologies (SNC IT, formerly SNC Defence Products Limited) moved the small-caliber cartridge-case production to St Augustin and small-caliber LAP to Le Gardeur.³¹

In 1991, SNC IT also filed a lawsuit against the government to compensate it for the loss in value of the former CAL assets that occurred with the unexpected decline in ammunition purchases by the Canadian government after the end of the Cold War. The suit was finally settled in 1994. The government agreed to an immediate

plus contracting allows adjustment of prices to account for unanticipated costs or savings. This is contrasted with fixed-price contracting, which sets a price prior to contract execution and does not allow for retrospective price adjustments.

³⁰ Closing St Augustin was never a serious option because the plant was quite new at the time—only five years old.

³¹ SNC also acquired Lavalin in an asset purchase in 1991 and became SNC-Lavalin Group Inc. We will refer to the company as SNC or SNC-Lavalin for brevity.

payment to SNC IT of CA\$15 million. Additionally, and in an indication of the government's growing reliance on SNC IT as its ammunition manager,³² it gave SNC IT the exclusive right to sell surplus stocks of government-owned military ammunition for a share of the profits.³³

In August 1991, The SNC Group acquired the engineering and construction assets of Lavalin, making it the largest engineering-construction firm in Canada (The SNC Group Inc., 1991, p. 2). Throughout the 1990s, SNC (later renamed SNC-Lavalin Group Inc.) continued to acquire other firms in engineering, construction, facilities management, agrifood, pharmaceuticals, and telecommunications. Although ammunition revenues remained relatively steady during this period, they represented a declining share of SNC-Lavalin's total revenues.

SNC's role as Canada's primary military ammunition supplier and manager was solidified with the 2001 acquisition of EXPRO, the energetic materials production facility at Valleyfield, Quebec. From the time it was first privatized in 1965 until SNC TEC (formerly SNC IT) bought it in 2001, the Valleyfield facility had been barely improved, except for a modern multibase propellant line built in the 1990s. World War II era production processes and equipment were retained, while safety and environmental problems continued to plague operations. The government continued to provide financial support, but just enough to keep the facility running. Like the rest of Canada's defense industrial base, EXPRO suffered a serious decline in sales with the end of the Cold War. In fact, in the early 1990s it permanently ceased production of explosives, for which there was not a large enough market to justify needed plant improvements, to con-

³² Today, SNC TEC is also the configuration manager for the ammunition it produces, operates the GOCO ammunition testing facility at Nicolet, and is considering management of the government's ammunition storage depots if they are converted from government owned, government operation (GOGO) to GOCO.

³³ "SNC-Lavalin to Receive Federal Compensation," 1994, p. E7. Canadian government approval is required for all sales. At the time, SNC-Lavalin valued this marketing role at CA\$15 million.

centrate solely on propellants.³⁴ Even that was not enough though to sustain the plant, and by the end of the 1990s EXPRO was verging on bankruptcy. A major fire in 1999 sealed that fate and precipitated discussions between DND and SNC TEC to determine what would be required to find and qualify a new source of ammunition propellant.

Maintaining a domestic source of ammunition propellant was in the interests of both the government and SNC TEC. For policy reasons, the DND was anxious to maintain domestic propellant production. Failure to do so would imperil the entire ammunition policy of the MSP and call into question whether Canada needed to maintain any ammunition industrial base. Maintaining a domestic source would clearly affect SNC TEC's business base since the Canadian military's ammunition requirements help to maintain SNC TEC's competitiveness in export markets. Additionally, gaining a propellant production capability would enhance SNC TEC's strategic position in the ammunition industry.

Eventually, the Canadian government and SNC TEC agreed that the best course of action would be to continue propellant production at the current EXPRO site. The combination of setting up a new capability and cleaning up the Valleyfield facility would have been prohibitively expensive. As a result, talks were initiated between the Canadian government, SNC TEC, and the owners of EXPRO. These talks were aimed at facilitating SNC TEC's acquisition of EXPRO. The talks eventually failed. In 2001, SNC TEC acquired most of EXPRO's assets; then in 2002, EXPRO declared bankruptcy. Although SNC TEC had acquired most of EXPRO's assets, including the equipment and the buildings at Valleyfield, the province of Quebec agreed to accept title to the land itself.³⁵ SNC TEC did not want the environmental liability that would come with ownership of the land, and the province wanted the failing plant to continue to operate

³⁴ EXPRO now produces full-range single, double, and multibase extruded propellants.

³⁵ The land, which the federal government sold to CIL in 1965, had been in private hands since then.

and contribute to the provincial economy. Hence, the provincial government took ownership of the land. But today both the provincial and federal governments fund the environmental remediation.

Today, production at Valleyfield continues under management of EXPRO TEC as a subsidiary of SNC TEC. With financial assistance from the federal government, the firm is upgrading and cleaning up the Valleyfield facility to make it viable for the long term.

One last SNC TEC expansion is worth noting. Before 1998, the Canadian government operated an ammunition testing and proofing facility at Nicolet, Quebec. In that year, SNC TEC won a contract to manage Nicolet as a GOCO. Since taking over, SNC TEC has managed to improve service at Nicolet with a staff one-third the size and drastically reduced infrastructure.

Thus, SNC has used the last two decades to dominate Canada's once government-run industrial base for conventional ammunition. SNC-Lavalin's defense business has been consistently more profitable than its other lines of business. In each of the last six years, its defense business has accounted for a greater percentage of the firm's operating income than its revenues. Table 3.2 shows SNC-Lavalin's defense revenues and operating income from 1997 through 2002 (in then-year dollars) and their percentage of SNC-Lavalin totals. Although SNC is the dominant ammunition supplier in Canada, ammunition now represents only a small fraction of the SNC-Lavalin's total business base.

Table 3.2
SNC-Lavalin Defense Revenues and Operating Income

	1997	1998	1999	2000	2001	2002
Defense revenues (millions of CA\$)	194.5	175.4	171.5	208.0	211.4	277.4
Defense operating income (millions of CA\$)	13.9	11.1	12.9	12.1	12.4	16.3
Percentage of total revenues	14%	12%	13%	12%	9%	8%
Percentage of operating income	20%	15%	17%	14%	11%	11%

SOURCE: SNC-Lavalin Group Inc., 1998–2002.

NOTE: Defense revenues include the revenues of Securiplex, which makes fire protection systems, in addition to ammunition.

The Continuing Evolution of Industrial Base Policy

We now step back in time to catch up on the continuing evolution of post-MSP industrial policy during and after the period of The SNC Group's purchase of CAL. In the early 1980s, a review of the MSP by DND and DSS found that it had been successful in strengthening the Canadian munitions industry, improving Canada's self-sufficiency in high-volume-usage ammunition, reducing ammunition costs, and increasing ammunition exports. However, a 1988 review of the MSP by the Canadian Auditor General (Government of Canada, 1988) found a number of shortcomings. At the time, approximately 75 percent of the dollar value of DND ammunition contracts was let to Canadian companies, although some ammunition components were purchased abroad. Government funding was provided for some modernization of facilities and equipment, and contracts were awarded on a cost-plus-profit basis, but production technology still tended to be of World War II vintage, and prices remained about 30 percent higher than the lowest prices available from other NATO suppliers. In addition, to maintain production levels, DND had been buying more ammunition than was required for annual training. As a result, training ammunition stocks exceeded authorized levels by about 33 percent, or approximately one year's usage.

In terms of achieving Canadian self-sufficiency, the 1988 review found that at least 90 percent Canadian content had been achieved on about 25 percent of the ammunition items considered critical for war. These items accounted for about half the value of annual ammunition procurement. Another 11 percent of the items had at least 60 percent Canadian content, but 25 percent had less than 10 percent Canadian content, and Canadian content could not be identified on the remaining 39 percent. The review also found that little was being done to stockpile critical components or raw materials that were not available in Canada.

DND and PWGSC are considering a revision of the MSP to reflect changes in DND's ammunition requirements over the last 25 years. Changes could include a broadening of the MSP to cover ammunition support services (such as configuration control, acceptance

testing, and sales and demilitarization of excess ammunition), R&D of new ammunition types, and revision of the list of ammunition types included.

Changes in Ammunition Contracting Policy

At the time of CAL's privatization, contracts generally covered ammunition requirements for two to three years. Technically, the price for each ammunition type and an annual overhead rate were fixed before production in annual negotiations with DSS, but costs were audited after production and payments reduced if cost savings occurred or profits were higher than expected. For the first few years after CAL's privatization, SNC continued to operate the plants under the same contracting arrangements. Under this contracting format, SNC had little incentive to modernize or to reduce costs. As a result, it was not able to attract many export sales.

In the face of declining government buys, SNC became more interested in developing its international business to survive. As a result, both DSS and SNC saw benefits to changing contracting policies to give SNC incentives to reduce its overhead rates, to modernize, and to increase its profits by accepting more risk. In 1989–90, DSS began to negotiate lower overhead costs with SNC. Based on a business case detailing investment costs and forecasted savings, the Canadian government agreed to hold ammunition prices fixed for three years while SNC consolidated its operations at the sites at Le Gardeur and St Augustin and closed the Valcartier site beginning in 1991. At the end of three years, DSS and SNC renegotiated ammunition prices and overhead rates based on audited costs.

A further change in contracting policy began coincident with the new settlement agreement in 1996. Rather than negotiating separate contracts for each ammunition type included in the ten-year settlement agreement, the government bundled all such requirements into a single, annual contract. Bundling the contracts gave PWGSC better visibility of total costs.

Until 2002, the government set a ceiling price for ammunition rather than a fixed price, and any savings under the ceiling price were shared between SNC and the government. Beginning in 2003, however, SNC was entirely at risk for any cost overruns and retained all the additional earnings that accrue from beating the negotiated costs. There are no longer end-of-year audits that retroactively change prices. Further, the firm now bears the foreign exchange risk. It now operates with one-year firm fixed-price contracts. Experience, however, does play a role in negotiating future one-year contracts. With regard to international sales, the government and SNC share the profits.

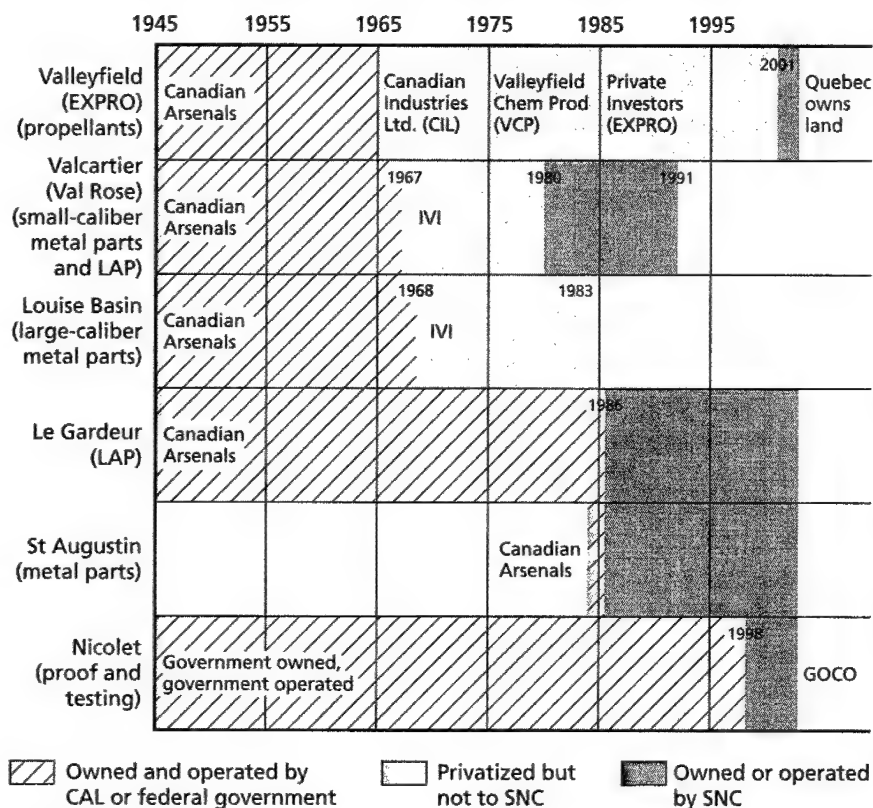
Summary

From its confederation in 1867 until the privatizations of the 1980s, Canada relied on a mix of government and private munitions manufacturing. During periods of peace, when standing armies were small and munitions requirements were tiny to nonexistent, Canada maintained only a modest set of government-owned arsenals, typically underfunded and underutilized. During the two world wars, the nation relied on a mix of public and private expansions to meet its needs. After World War II, creation of the crown corporation CAL provided for post-war and early Cold War needs. The 1960s saw the beginning of a more than two-decades-long transition from government to private ownership of munitions plants.

As Figure 3.3 shows, the Canadian ammunition industrial base has, over a period of more than three decades, been transformed into a base that is entirely privately operated and is, except for provincial ownership of the land at the Valleyfield plant, privately owned.³⁶

³⁶ The Nicolet proofing and testing facility is excluded because it conducts no manufacturing functions. It is included in the figure only for completeness because it is now part of SNC.

Figure 3.3
Chronology of the Privatization of Ammunition Manufacturing in Canada



RAND MG169-3.3

The cross-hatched areas at the left represent periods during which each of the plants was owned and operated either by the government directly or by CAL. The light shading in the middle represents periods after which the plants had been privatized but were owned by entities other than SNC. The dark areas, at right, represent periods of SNC ownership.

In sum, a first wave of privatizations occurred in the 1960s at the initiative of private firms seeking to purchase government-owned plants. In 1965, Valleyfield became the first CAL plant to be privatized. Valcartier followed suit in 1967 and Louise Basin the next year. The privatization of plants as going concerns was accompanied by

closures and consolidations of plants no longer needed. The 1978 promulgation of an industrial base policy paved the way for the privatization of the remaining government-owned ammunition plants in 1986. This second privatization came as a part of much broader divestitures of government-owned functions in Canada, the United Kingdom, and other nations. SNC entered the market in 1980 when it bought the Valcartier plant from IVI. In 1986, SNC bought the two remaining CAL enterprises, Le Gardeur and St Augustin, to complete the privatization. It solidified its dominance when it bought the Valleyfield assets in 1991. Since it acquired most of Canada's ammunition industrial base, SNC has rationalized and consolidated that infrastructure and, in partnership with the Canadian government, introduced innovations that have permitted the firm to maintain a reliable domestic source of production and meet the declining needs of the Canadian government while growing its international business.

We interviewed a number of Canadian government officials, both current and former, about their satisfaction with the outcomes of privatization. Responses were unanimous in their support for private ownership as a superior solution to government ownership. We found no support, neither among those interviewed nor from published sources, for renationalizing the plants.

Military, Economic, and Political Context of Ammunition Manufacturing in the United States and Canada

Before we can assess the relevance of the Canadian privatization to the United States, it is appropriate to highlight the comparative military, economic, and political situations in the two countries.

The most prominent difference between the two nations is the matter of scale. Table 4.1 compares the economies, populations, and defense establishments of the two neighbor nations. Canada's economy and population are about one-tenth of those of the United

Table 4.1
Selected Statistics for United States and Canada, 2002
(US\$)

	Canada	United States
Gross domestic product	\$0.92 trillion ^a	\$10.4 trillion ^b
Defense budget	\$7.86 billion ^c	\$350.7 billion ^d
Defense budget as % of gross domestic product	0.85%	3.4%
Population	31.4 million ^e	280.6 million ^a
Active military strength	60,000 ^f	1,455,000 ^g

^a NationMaster.com, 2003.

^b U.S. Department of Commerce, 2003. Defense budget figures are for fiscal years ending in 2002. The Canadian fiscal year ends on March 31, that of the United States ends on September 30.

^c U.S. Central Intelligence Agency, 2003.

^d U.S. DoD, 2002, p. 4.

^e Government of Canada, 2003c.

^f Government of Canada, 2002a.

^g U.S. DoD, 2002, p. 212. The U.S. strength includes full-time reserve personnel.

States, but Canada spends only about one-fiftieth as much on defense and maintains an active military force only about one-twentieth the size of that of the United States. In 2002, about one out of every 523 Canadians was serving on active duty, while one out of every 193 Americans was doing so. Further, the Canadian government spends about 0.85 percent of its gross domestic product on defense, while the United States spends about four times that proportion, about 3.4 percent.

Despite the differences of scale between the two nations, the benefits and risks of privatization appear independent of scale. Hence, the lessons available from the Canadian experience are worthy of study and can provide policymakers in the United States with significant insight.

Military Context

The missions of the Canadian and U.S. militaries differ in important ways. The United States, with a population and an economy 9 and 11 times, respectively, those of Canada, has a strategic interest in maintaining international security and has taken on global military responsibilities. While the end of the Cold War temporarily dampened the U.S. commitment to these responsibilities, the events of September 11, 2001, and the subsequent war on terrorism have reinvigorated its sense of global commitment. By contrast, Canada's global responsibilities are more modest. The mission of the Canadian forces is to "defend Canada and Canadian interests, while contributing to international peace and security" (Government of Canada, 2003a, p. 1). Relative to the United States, the Canadians concentrate their security efforts much more on homeland rather than international security. And since the northern tier of the Western Hemisphere is one of the most naturally and politically secure locations in the world, a large armed force is not required. Despite this, the Canadian government has serious responsibilities to NATO and maintains its military commitment to the alliance. Even so, the military

commitments of Canada are clearly dwarfed by those of the United States.

The role taken by the United States, vis-à-vis Canada, in maintaining international security requires a much larger defense budget (US\$350 billion for the United States compared with US\$8 billion for Canada in 2002)¹ and supports a correspondingly larger defense industrial base. The large scale of U.S. procurement permits the United States to maintain a more independent view of its industrial base than do nations such as Canada, whose smaller procurements require more integration with other nations to benefit from economies of scale in manufacturing. Hence, for reasons of cost, Canada cannot even entertain the notion of a wholly domestic industrial base, be it private or public. For that reason, government ownership of the base is not an important consideration.

It could be argued that U.S. military commitments make its demand for military equipment and supplies more inelastic, particularly in the case of consumable items such as ammunition, which may require a surge in production to meet urgent operational demands or to replenish depleted war reserve stocks after a conflict. If Canada, because of its geopolitical circumstances, has more flexibility concerning commitments to military action than does the United States, then its requirements on its military suppliers can also be more flexible.

Despite the more stringent demands placed on the suppliers of U.S. military equipment, however, government ownership of the means of production has not been demonstrated to be essential. The vast majority of the U.S. defense industrial base is privately owned, and for all but the most capital-intensive weapon system production, the U.S. defense budget is large enough to support multiple privately owned producers who compete to meet U.S. government demand. More telling, many items that are critically important to the military, including consumables such as missiles and tires, are manufactured entirely or primarily in the commercial sector. Rather than ownership

¹ The FY 2005 U.S. defense budget is likely to exceed \$400 billion.

of production assets, the real issues at stake are the ability to define the requirements for military production, both actual and potential, and then to provide resources to ensure those requirements are met.

In Canada's case, the DND buys and stockpiles the conventional ammunition that it anticipates will meet its military obligations. Beyond that, the relatively benign military environment of Canada allows the country to be more flexible than the United States is in terms of defining industrial requirements for surging ammunition production or requiring increased production, post-conflict, to replenish depleted war stocks. As a result, rather than define a specific capability for surge, or some above-normal replenishment production rate, the Canadian government has been content merely to specify that SNC and other ammunition providers named in the MSP maintain a capability to produce certain ammunition types. Capacities are based on what already exists and are tacitly agreed to by SNC and the government in their periodic negotiations. Such an informal arrangement is probably not enough for the U.S. DoD, but it demonstrates the feasibility of separating payments for maintaining capacity from payments for current production. The Canadian example also demonstrates that private companies are willing to maintain production capability for surge or replenishment, provided that capability is paid for.² This fact suggests that a fully privatized ammunition industry in the United States could also provide surge or replenishment capability if the cost of such capability were identified and paid for.

Economic Context

Reflecting their relative populations (281 million compared with 31 million) and differing military missions, the armed forces of the United States are larger than Canada's in terms of personnel (1.4 million compared with 60,000) and budget (US\$350 billion versus US\$8 billion), by well over an order of magnitude. Ammunition

² As mentioned elsewhere, the Canadian DND estimates that it pays a premium of 20–25 percent for its ammunition to maintain an indigenous ammunition production capability.

budgets compare by a similar measure. Even though more than two-thirds of U.S. ammunition production occurs in privately owned plants, the dollar amount of ammunition manufactured in U.S. government-owned plants today (more than US\$600 million a year—Hix et al., 2003b, p. 167) is still several times the size of the entire Canadian ammunition budget (CA\$149 million). Hence, privatization of the remaining government-owned segment of the U.S. ammunition industrial base would represent a more significant change than the privatization of the Canadian base in an absolute sense, but not relative to the size of the U.S. economy or the defense budget.

In reality, the effect of privatizing the U.S. ammunition industrial base is likely to be neither immediate nor large. Both the Canadian government and SNC officials we spoke with agreed that the 1986 privatization of CAL resulted in no increase in costs to the government and has since permitted substantial efficiencies that have led to reduced prices. While most ammunition items in the U.S. inventory have some content that is produced in government-owned facilities, private-sector companies already manage the vast majority of the U.S. ammunition industrial base. More important, privatizing the ammunition base in the United States will not change the demand for ammunition items by the U.S. military, and current industry players, whether producing in government or privately owned facilities, will remain the dominant suppliers of these items for some number of years. Their current market position provides them a significant competitive advantage that will take time to erode. If, as in the Canadian case, the U.S. government provides some guarantees of market share for a period of time, the near-term economic effect of privatization will be even less.

Over the longer term, the reported benefits to the Canadian ammunition industry that occurred in the wake of privatization would likely be even greater in absolute terms in the United States precisely because of the size difference. All the evidence provided elsewhere in this report indicates that the Canadian ammunition industry has become more flexible and efficient in the years since full privatization. Of greater significance, as SNC stepped up its efforts to

expand its foreign sales, competitive pressures have forced it to accelerate efficiency improvements, to the benefit of all its customers. Privatization of the U.S. government-owned ammunition industry would also increase competitive pressures on that industry over time, in a manner similar to that seen in Canada. Similarly, these pressures would likely lead to rationalization and recapitalization of the U.S. ammunition industrial base as different ammunition market players strive to outdo their competition in cost and quality. And a privatized base might share the incentives the Canadian base found to build its international business.³ Since the size of the industry and the market are so much larger in the United States, as compared with Canada, the benefits of this process should be proportionately greater.

Political Context

The political systems of Canada and the United States differ in significant ways that influence the applicability of the Canadian ammunition industrial base privatization example to the United States.⁴ In contrast to the United States, which directly elects members of both houses of Congress and the president, Canada uses a parliamentary system of government. In that system, only members of the lower house, the House of Commons, are directly elected. The governor-general, on the advice of the prime minister, appoints members of Canada's upper house, the Senate, for life. As a result, members of the Canadian Senate need not worry about reelection and can act independently of provincial electoral interests. The prime minister and her or his cabinet are members of the House of Commons and are

³ One cautionary note: U.S. arms export restrictions could limit the extent of international growth. Appendix B provides an overview of these policies; a more thorough study lay outside the scope of this report. Nevertheless, as pointed out earlier, the large scale of domestic arms buys provides domestic competition that Canada lacks.

⁴ Details about Canada's government are from Library of the Canadian Parliament, 2003.

drawn from the ranks of the majority party in power.⁵ The prime minister is also the leader of the majority party and so holds very considerable influence in the House of Commons. Additionally, most legislation is introduced into the House of Commons by the cabinet.⁶ The result is that the majority party from the most recent election holds proportionately more power in Canada than the majority party in the United States. When the Canadian majority party is elected on a broad mandate, such as the privatization platform of the Mulroney campaign, that party has tremendous power to implement its vision. By comparison with the U.S. system, the alignment of Canada's executive and legislative branches and the resulting unity of political power allows the Canadian Parliament to focus more on larger national issues and less on provincial ones. Finally, members of the House of Commons face election only every five years rather than biennially, as is the case for the U.S. House of Representatives.⁷ The difference in election cycles means that members of the Canadian Parliament tend to be less engaged than are members of the U.S. Congress when proposed policy and legislation will have a local impact.

When serious privatization of Canada's ammunition industry began in the mid-1960s, the size of that industry was proportionately larger than the government-owned U.S. ammunition industry today but still substantially smaller in absolute terms. The smaller bureaucracy in the DND and DSS charged with managing Canada's government-owned ammunition industry made it easier to gain consensus than can currently be expected in the United States. That the privatization process occurred over a span of two decades, affecting a relatively very small number of people at any one time, also may have made privatization politically less complicated.

⁵ When no party is in the majority, the prime minister comes from the party that was able to form a governing coalition with other minority parties. Cabinet members are then drawn from the coalition member parties.

⁶ Only the cabinet introduces taxing and spending legislation.

⁷ Canadian elections can occur more often if called for by the prime minister or after a vote of no confidence.

The management of affected employees during Canada's 1986 privatization was a subject nearly all involved in the process regarded as critical. Though all the privatized facilities were operated as part of a crown corporation, the employees enjoyed certain benefits of government employees. Most important of these was a valuable defined-benefit retirement plan. Ensuring that employees perceived the privatization as fundamentally equitable to their interests was essential to minimizing any political concerns the process might cause. In the United States, this lesson applies mainly to the government employees. The Canadian experience teaches, among other lessons, that the expectations of these personnel for job security, salary, and retirement must be addressed for the privatization to be successful.

The U.S. GOCO plants employ only a handful of government employees; the GOGO plants each employ several hundred. Regardless of the number of employees, the issue of compensation and benefit protection for government employees must be addressed in any privatization.

Canada's parliamentary system probably made privatization politically simpler and more acceptable than it would be in the United States, particularly during times of reaction to the government's overall size and reach. Additionally, the small size of the Canadian ammunition industrial base, the long time period over which privatization occurred, and the industry's organization as a crown corporation (hence, it was "pseudo" private already) all combined to ease political concerns in Canada about privatization.

It does not necessarily follow, however, that these factors make the Canadian example of ammunition industrial base privatization inapplicable or less compelling for the United States. Members of the United States Congress, indeed, protect the employment of constituents, particularly government employment. Of the 14 ammunition plants in question, government employees manufacture ammunition in only 3. Government employment at the other 11 facilities is very small, generally consisting of only a handful of government employees in each plant to carry out the inherently governmental functions

of command, safety, auditing, and contract management.⁸ This fact, along with three other lessons from the Canadian example, could make the privatization of the U.S. ammunition industrial base politically appealing.

In 1986, when Canada privatized CAL, the MSP—while not providing absolute production guarantees—did lend a great deal of confidence that the newly privatized facilities would continue to produce ammunition for the Canadian government. As it turned out, the economically more important factor in the Canadian case was that the circumstances that resulted after, and because of, privatization both enabled and encouraged Canada's ammunition industry to expand its foreign sales. Over the longer term, this expansion has stabilized and improved the employment situation in the industry, thereby providing one important lesson for the United States.

Similarly, a U.S. plan that guarantees production for a period of time to newly privatized facilities could be implemented. More important, the potential economic development at privatized ammunition facilities makes potential employment growth and stability more possible than otherwise under current conditions. This economic development, which is a second important lesson, was the case in Canada and should be emphasized during any privatization exercise in the United States.

Further, U.S. ammunition plants could be sold as going concerns rather than being closed before sale—a third lesson—as in a base realignment and closure. If plants are sold as going concerns, contractor employees at the GOCO plants would likely keep their jobs over the short term. And if the Canadian experience proves out, employment would actually increase. Purchasers of plants would also be free to use some of the property for uses other than ammunition manufacturing, providing further opportunities for expanded employment.

⁸ Very few government employees were affected in the Canadian case. Prior to privatization, a crown corporation managed the Canadian ammunition industry. These organizations are government owned, but the employees work directly for the corporation, not the government.

Summary of Insights Gained from Study of the Canadian Experience

The following summarizes the principal findings of our assessment of the applicability of lessons learned from the privatization of Canada's ammunition manufacturing to the U.S. ammunition industrial base.

The privatization of Canada's ammunition industry, while not an exact analog of the privatization possibilities open to the U.S. DoD today, does offer important insights about the factors of a successful privatization. Specifically, it seems clear that the private sector in both nations can and will respond to demand for government ammunition. The Canadian example shows that a privatized industry will maintain an industrial capability when required and resourced by the government—but not without oversight.

Summary of Findings

Canadian Government Satisfied with the Results of Privatization

We found no expressions of interest on the part of current or former Canadian government officials for returning to government ownership of plants. All report that privatization of Canada's ammunition industry has had positive economic results. SNC enjoys reasonable profitability. Further, indirect evidence substantiates the positive outcomes. For example, despite sharp declines in government ammunition procurement, employment and production at all three SNC plants have increased since privatization, and SNC's global market share has increased dramatically. At the same time, plant productivity

has improved, lowering prices to the government. Both of these outcomes result in part from the imperatives private manufacturers have to expand their business base beyond the Canadian government and to respond to competitive incentives of the international market. By contrast, operators of U.S. GOCO facilities, who do not own the property or equipment, have fewer incentives to improve productivity through modernization. Further, the U.S. government constrains the extent of their nongovernment business, limiting their exposure to competitive pressures and the ability to compete internationally. For a broader review of problems associated with the U.S. base, see Hix et al., 2003b, pp. 31–52. We expect that privatization of the government-owned ammunition industry in the United States would show positive results similar to those Canada now enjoys.

Canadian Experience Valid for the United States

The positive outcomes the Canadians report—increased employment and lower prices—resulted from the incentives private owners had after privatization to expand their business base, not from the relatively small size of the base. In fact, the larger U.S. government procurement could provide an even more substantial underpinning than has the relatively anemic and declining Canadian government ammunition procurement budget. Further, to the extent that the United States is concerned about a large privatization all at one time, the initiative could be undertaken in phases, as was the case in Canada.

Preparation of Plants for Sale Enhances Their Attractiveness

Before offering its plants for sale, CAL undertook an eight-year program to streamline its operations, rejuvenate its management, increase its revenues, and improve its profitability. Between 1978 and 1985, the organization was able to turn annual losses into steadily increasing excesses of income over expenses and increase its income by more than tenfold. Without these preparations, the plants would have been more difficult to sell and, if sold, would have fetched a far lower price, consistent with the financial status of the plants. This lesson is most important to the U.S. GOGO plants and arsenals. For these entities, which like CAL in the 1970s now require substantial sup-

plemental funding on top of customer revenues to break even, it might be useful to take the transitional step of creating an FGC to improve their business processes and financial picture before attempting to sell them (See Hix et al., 2003b, Chapters Four and Six, for a detailed discussion of the FGC transitional model). For the GOCO plants, whose operations are now profitable, the preparation problem is less significant. Before selling the GOCO plants, the government would need to concern itself with the condition of the physical plant, demonstrating the viability of tenant activities and ironing out the transitional issues associated with the environmental liabilities, which need not be remediated before sale if the land is to be used for a like purpose (U.S. General Services Administration, 2003).

Potential Role of States in the Disposition of U.S. Ammunition Plants

Because SNC was reluctant to take on the environmental risk at Valleyfield when it bought the EXPRO assets there, the Province of Quebec took ownership of the land from its former private owner as a measure to ensure continued production and employment at that environmentally mistreated property. Due to the stricter provisions of U.S. environmental law, the same environmental liability situation could not occur in the United States.¹ Nevertheless, in cases where a state may have a use for a federally owned ammunition plant, use of that property could be shared with continued federal users, or in the case of "laid-away" plants, the federal government could either sell or permit the state to use the property until such time as it is needed. Recently, the State of Louisiana expressed an interest in using Louisiana AAP, a laid-away facility, for training its National Guard. The

¹ The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 U.S.C., Chapter 103), sometimes referred to as the "Superfund" law, provides for "strict, retroactive, joint and several liability." This means that all past owners and operators of a property retain liability for any contamination that occurred during their tenures. Sale of the property does not transfer that strict, retroactive liability. According to discussions among government and industry officials, Canadian law (Canadian Environmental Protection Act of 1999) apparently is somewhat less stringent, permitting negotiations of liability as a part of a sale or transfer of property. Canada does adhere to the principle of "polluter pays," but in several instances the law limits liability to negligent or willful conduct.

matter is under study at this time. It may provide a useful template for other plants, particularly those no longer useful for ammunition production. Importantly, though, any transfer of property to the state for purposes other than its current use would require the federal government first to conduct all the environmental remediation necessary on the site.² The liability at Louisiana AAP is estimated to be \$11 million (Hix et al., 2003b, p. 240).

Competition Matters

SNC enjoys near monopoly status in providing the munitions listed in the ten-year settlement agreement. Hence, SNC possesses substantial bargaining power in its negotiations with the government. But the government, too, has substantial bargaining leverage. It pays SNC for the substantial infrastructure costs resulting from the government's policy of maintaining a domestic capability. Because SNC also competes in international markets, the Canadian government benefits from the increased productivity and efficiency that SNC achieves due to competitive pressures of its international sales. Therefore, the government need not directly compete its buys to derive the benefits of competition from its private industrial base; international competition serves that purpose. The size of the U.S. market and the number of U.S. manufacturers would likely result in competition even for government contracts after privatization of U.S. plants.³

Privatization Does Not Relieve the Government of the Need for an Industrial Base Policy

Regardless of whether a domestic industrial base is public or private, so long as the government has an interest in its continued existence it needs a set of policies concerning the following:

² The FY97 National Defense Authorization Act allows the transfer of defense property to private owners before remediation is completed provided the facility is to be used for a like purpose and certain other conditions are met. See U.S. General Services Administration (2003) for the details of this provision.

³ Nevertheless, it would likely be necessary to offer as an incentive a guarantee of some long-term contracts before buyers of plants are later subjected to competitive pressures (Hix et al., 2003b, p. 154).

1. *Which items will be manufactured domestically?* Canada decides this question every ten years when it publishes its settlement agreement. Today, some 30–40 ammunition items appear on the list. All will be manufactured in Canada and by SNC. Certain components and ammunition end items are competed or procured from foreign sources, most notably but not exclusively from U.S. sources.
2. *To what extent will the base be subjected to competition?* In Canada, SNC is the preferred supplier for the 30–40 ammunition items appearing in its settlement agreement. Appearance of an item in the settlement agreement grants SNC, except in unusual circumstances, sole-source status for the listed product unless its price, schedule, or quality goes very much awry. As mentioned above, other items may be competed. By contrast, the completely private sector of the U.S. ammunition base enjoys much less protection and is subject to more competitive pressures.
3. *To what extent will the government subsidize a privately owned base?* The Canadian government pays the fixed costs associated with the existence of SNC's three plants. In other words, the government makes an explicit annual payment to SNC equal to the estimated overhead at each plant that would accrue if government production were undertaken alone. Other policies, resulting in fewer direct costs to the government, could be rationalized. In comparison, the U.S. government provides subsidies to its government-owned base but generally not to ammunition manufacturers operating their own plants. The U.S. GOCO base is generally no longer "work loaded" but enjoys competitive advantages through government ownership of capital (the unique scale and experience of certain plants) through subsidies in the form of the Armament Retooling and Manufacturing Support (ARMS) Program (Hix et al., 2003b, pp. 48–49, and Hix et al., 2003a, Appendix A), and other policies.
4. *Will private firms in the base be permitted to fail financially?* Two owners of the Valleyfield plant have gone bankrupt. In both cases, the government attempted to prevent the failures through loans

and special payments but in the end decided to let the firms fail then find new owners to continue production at the plant. In the U.S. GOCO base, failures have been rare.

Further, as the Valleyfield experience shows, to the extent that a privatized base remains important to the government, the government must take measures to ensure that private owners make sufficient investments to ensure the continuing viability of the capability. But Dominion Arsenal's woeful experience in the late 19th century shows, even government-owned facilities can be neglected.

The central point here is that privatization does not obviate the need for an industrial base policy. It does, however, obviate the need for government management of plants.

Bankruptcy of a Private Supplier Does Not Necessarily Create a Crisis for the Government

Despite the financial failures at Valleyfield, government requirements continued to be met. Oftentimes, bankruptcies mean only financial reorganizations in which the existing firm ends up stronger than before. Hence, fear of bankruptcy should not pose a deterrent to privatization. Virtually the entire U.S. industrial base is already privatized, including 70 firms that receive about two-thirds of U.S. ammunition dollars.

Selection of Buyers Matters

When the Canadian government decided to privatize CAL in 1986, it chose to invite only a handful of highly qualified firms to bid. It was more interested in ensuring reliable, responsible manufacturing than it was in generating the highest possible proceeds from an investor unschooled in the business. A similar approach might serve the United States as well in any future privatizations.

Contract Types Matter

After the 1986 privatization of CAL, the Canadian government continued with cost-plus contracts that lacked incentives for improved

productivity. At the end of the Cold War, SNC realized it needed to compete internationally to grow its business and survive in the face of sharply declining government purchases. Accordingly, SNC and the government agreed to new contract vehicles that provided incentives for the firm to become more efficient and share in the rewards of improved productivity. Privatization proved a necessary, but not sufficient, action.

The Congeniality of the Canadian Political System to Privatization

As discussed in detail in Chapter Four, the parliamentary system of Canada generates less organized political opposition than is the case in the United States, making U.S. privatization more difficult, and possibly explaining in part the continued government ownership of the U.S. base in the face of near complete privatizations of similar activities in the U.K., Australia, and Canada. Nevertheless, privatization has been shown to be politically feasible in the United States.

Advantages of Gradual Privatization

The three sequential Canadian privatizations of the 1960s permitted the Canadian government to learn from each prior experience and provided long-term lessons for the 1986 CAL privatization. Most important, in part because of its experience with Valleyfield, the government restricted its 1986 solicitation to only a handful of stable, reliable, experienced Canadian firms. Further, the early experience mitigated any residual anxiety in DND and the Canadian forces about privatization. This aided the political process. Any U.S. privatization could benefit as well from a sequential process (Hix et al., 2003b, pp.152–160).

Providing for Affected Employees Is Essential

In the 1986 privatization, the Canadian government worked closely with CAL and SNC to ensure that employees would not suffer financially from the privatization. CAL employees were offered a choice of remaining in their defined-benefit pension plan, with continued contributions by SNC, or having the government transfer the actuarial value of their accrued benefits into SNC's defined-contribution plan.

This measure mitigated employee opposition and eased the political process. The imperative would be just as essential to any U.S. privatization.

Final Words on the Relevance of the Canadian Experience for the United States

Opponents of privatization of U.S. Army plants typically offer variations on one or more of the following three arguments in favor of the status quo: The private sector will not respond to the competition for sale of government ammunition plants, privatization will increase costs to the government, and private ownership is too risky. (See Hix et al., 2003b, Chapter Five, for a thorough treatment of these arguments.)

With respect to the first argument—a potential lack of responsiveness on the part of ammunition manufacturers—the Canadian experience is instructive. Lack of private interest was simply not a problem. In the 1960s, private Canadian firms initiated purchase offers for three CAL plants that at the time the government had not even yet decided to sell. And in the government-initiated privatization of the remaining CAL plants in 1986, five invited firms responded with offers and even one uninvited firm entered a bid. At least two contractor operators of government-owned plants have made overtures to the U.S. Army about buying plants (Hix et al., 2003a, p. 37). Nevertheless, we cannot predict in advance of actual offers the extent of competition for U.S. plants, should the government offer them for sale. But the government bears no risk in offering the plants. The uncertain demand for plants reinforces the need for a gradual approach to privatization, such as the one that the Canadians employed.

The second argument—increased costs—has not been borne out in the Canadian experience. Canadian government officials report improved productivity and lower prices, particularly after the 1986 privatization. SNC's competitive position in the international ammunition market reinforces the value of the incentives competition

provides to improve a firm's efficiency. Today, the U.S. government-operated ammunition plants lack such incentives, as do the contractors who operate government plants under long-term facility-use contracts. While Canada lacks domestic competition for SNC, the firm prospers under the competitive pressures of international markets.

The Canadian story bears directly on the third argument—the risks of private ownership. At one of SNC's current plants, Valleyfield, two prior owners went bankrupt without significant production failures. SNC is now bringing that plant into a more competitive position. Certainly, private ownership entails a risk that government ownership avoids. But government ownership forgoes the largely positive results privatization can bring. The Canadian experience illustrates that a firm's financial failure need not equate to substantial risk to national security. If such fears were valid, the U.S. Army would be expected to propose nationalizing the assets of the 70 or so completely private plants that consume about two-thirds of the Army's ammunition dollars.

In sum, while there are no guarantees that the United States can successfully privatize its existing government-owned plants, the Canadian experience provides reasons for optimism. The Canadian success is reinforced by the continuing reliance of all of the United States' major allies on private ammunition manufacturing. Finally, the United States itself already successfully relies on the private sector for most of the dollar value of its ammunition and components. Collectively, these policies give cause for optimism that a measured approach to privatization of the U.S. base could bear similar fruit.

History of SNC

Early History

Arthur Surveyer founded SNC in 1911 as Arthur Surveyer & Co.¹ It offered services in a variety of engineering fields, including civil, mechanical, electrical, and municipal design, as well as field supervision services. Most of its early projects involved water, including hydroelectric power, municipal water supply, and navigation. In 1923, Emil Nenninger, a structural designer, and Georges Chênevert, a civil engineer, joined the firm. The firm's business broadened to include studies and designs for factories and buildings, particularly churches and church-run schools and hospitals. In 1937, Nenninger and Chênevert became partners in the business, although the name was not changed until 1947.

During the post-World War II economic expansion, SNC designed projects for textile, food, paper, building material, and chemical production, as well as large metallurgical and mineral projects. In the early 1950s, SNC started work on hydroelectric studies of northern Quebec rivers. This work provided the foundation for later expansion to international hydroelectric projects in Asia, Africa, and Latin America. Surveyer, Nenninger, and Chênevert was incorporated in 1964. A group of employees bought out the partnership in 1967, and SNC Enterprises Ltd. was formed as a holding company of a growing number of subsidiaries.

¹ This appendix is based on The SNC Group (1986), pp. 35–42.

SNC set out to acquire more subsidiaries and to form joint companies and consortia to broaden its technological base and geographic coverage. The firm began to develop its project management skills to take on ever larger projects and to perform them on schedule and within budget. Staff grew from less than 900 in 1970 to close to 5,000 by the end of the decade. Revenues quintupled, and more than half came from outside Canada. SNC built its strength in specific project areas, including forest products, chemicals, petroleum, mining, and metallurgy.

In the late 1970s, SNC recognized the need to begin to diversify its operations. It set up its own research and development group in 1979 to keep abreast of emerging technologies and acquired its first manufacturing operation in 1980 when it bought IVI. The recession of the early 1980s prompted the postponement or cancellation of many major industrial projects. The SNC Group responded by acquiring more manufacturing interests and stimulating its engineering-construction business by promoting and investing in its own projects.

Growth of Ammunition Revenues

In 1980, The SNC Group was one of the largest Canadian companies providing project management, engineering, procurement, construction, and commissioning services. It ranked among the world's top ten engineering design firms and was owned by its employees. However, inflation, recession, a highly competitive market, and government concerns about energy projects prompted The SNC Group to look for manufacturing investments that could counteract its vulnerability to economic downturns (The SNC Group, 1981, pp. 2, 9). On September 1, 1980, it purchased IVI, a manufacturer of small-arms ammunition for military and sporting use, from one of its directors, R. Guy Godbout. The SNC Group paid CA\$7,000,000 in cash and assumed liabilities of CA\$8,502,000. An additional CA\$2,406,000 payment was made based on the successful operation of IVI through March 31, 1983 (The SNC Group, 1981, p. 25, and

1983, p. 12). A breakdown of The SNC Group's revenues from 1978 through 2002 is given in Table A.1.

IVI's small-arms ammunition plant was built by the Canadian government in 1938 and had been privatized in 1967. Soon after-

Table A.1
SNC Group Revenues (millions of CA\$)

Year	Ammunition Revenues	Manufacturing/ Defense Revenues	Manufacturing/ Defense Exports	Other Revenues	Total Revenues
1978	0	0	0	102.9	102.9
1979	0	0	0	132.9	132.9
1980	13.3	13.3	N/A	159.9	173.3
1981	54.6	54.6	N/A	157.1	211.7
1982	51.5	51.5	N/A	165.4	216.9
1983	N/A	39.5	N/A	166.2	205.7
1984	36.7	36.7	2.5	169.4	206.1
1985	49.6	52.1	2.1	171.2	223.2
1986	161.8	164.1	15.3	185.7	349.8
1987	234.1	237.6	16.2	203.2	440.8
1988	146.9	157.1	10.4	163.6	320.7
1989	168.2	180.6	15.5	168.9	349.5
1990	198.4	213.5	11.1	233.9	447.4
1991	163.1	196.0	12.4	384.8	580.8
1992	148.9	199.2	27.4	547.9	747.1
1993	N/A	150.0	N/A	770.8	920.8
1994	N/A	146.2	N/A	815.7	961.9
1995	163.4	177.8	25.9	851.5	1,029.3
1996	175.4	187.2	43.3	1,174.7	1,361.8
1997	N/A	194.5	46.3	1,218.3	1,412.9
1998	N/A	175.4	42.1	1,332.1	1,507.5
1999	N/A	171.5	N/A	1,099.3	1,270.8
2000	N/A	208.0	N/A	1,532.4	1,740.4
2001	N/A	211.4	N/A	2,115.5	2,326.8
2002	N/A	277.4	N/A	3,154.2	3,431.6

SOURCES: The SNC Group (1981, 1983, 1985–1986), The SNC Group Inc. (1988–1993), and SNC-Lavalin Group Inc. (1997–2003).

NOTES: Ammunition revenues and manufacturing/defense exports are included in manufacturing/defense revenues. Manufacturing/defense revenues include the revenues of Securiplex, a manufacturer of fire protection systems for industrial and defense applications, beginning in 1985. N/A means not available.

ward, IVI purchased CIL's ammunition plant in Brownsburg, Quebec. Its staff and machinery were moved to Valcartier in 1977, and IVI entered the market for sporting ammunition with the Imperial and Canuck brands of shotgun shells and rifle cartridges. By 1980, IVI was the sole Canadian supplier of military small-arms ammunition to the Canadian government and the only manufacturer of commercial small-arms ammunition in Canada (The SNC Group, 1985, p. 18).

As part of a supply agreement with the Canadian government signed in March 1980, IVI had agreed to incur at least CA\$8,000,000 in operating expenditures over the next ten years to upgrade its production facilities. The SNC Group further agreed to incur CA\$12,500,000 in capital expenditures over the next five years to upgrade its production equipment. The DSS agreed to pay up to CA\$10,000,000 of these capital expenditures. However, SNC then had to reimburse 50 percent of the amount received within the five years following the commissioning of the equipment by yearly installments bearing no interest. The title deeds for the equipment remained with DSS until full reimbursement was made (The SNC Group, 1981, p. 27). Most of this investment program had been completed by the end of 1984 (The SNC Group, 1985, p. 25).

In 1983 and 1984, production at IVI was cut back while the plant retooled its 5.56 mm ammunition production line to meet new NATO specifications. Export customers at that time included Belgium, Holland, Kenya, and Indonesia. IVI also conducted R&D work on aluminum cases, caseless ammunition, and plastic shells (The SNC Group, 1985, pp. 7, 18). In 1984, SNC purchased a 12 percent share of Petro-Sun International Inc., a producer of solar energy components. This holding was increased to 32 percent in 1985. Petro-Sun's results were included in the manufacturing segment on a pro rata basis until the interest was divested in 1987 (The SNC Group, 1985, p. 18, and 1986, p. 24; and The SNC Group Inc., 1988, p. 26).

By 1985, the new 5.56 mm production line had started, and SNC's IVI subsidiary also opened a new 20 mm cartridge production line. The Valcartier plant was a fully integrated operation, including a

foundry manufacturing strips, brass cups, bullets, cases, and primers; loading, assembling, and packing operations; test ranges; and an R&D laboratory (The SNC Group, 1986, pp. 20–21). In the summer of 1985, the Canadian government called for proposals to purchase CAL, a crown corporation producing medium- to large-caliber ammunition (30 mm and above). SNC had long been interested in acquiring CAL as a complement to its small-caliber plant. In December 1985, the government announced that SNC had been selected as the preferred bidder, but the sale was subject to the passage of enabling legislation in 1986 (The SNC Group, 1986, pp. 7–8). SNC agreed to a purchase price of CA\$87,500,000 plus the repayment of CAL's debt to the government of CA\$4,725,000 (The SNC Group, 1986, p. 32). It also pledged to keep CAL's plants at Le Gardeur and St Augustin and its own Valcartier plant operating and to undertake immediate improvements at Le Gardeur. At the time, the defense market appeared to be stable and growing (The SNC Group, 1986, pp. 18–20).

In 1985, SNC also purchased Ginge-Kerr Canada Limited, a designer and producer of electronic systems for fire and damage detection and control, supplying industrial plants, ships, and offshore rigs and platforms. SNC renamed the subsidiary Securiplex Systems Inc., and its results are included in the manufacturing segment (later renamed defense) through 2002 (The SNC Group, 1986, p. 19).

At The SNC Group's annual meeting in March 1986, its employee shareholders agreed to issue shares to the public to finance the acquisition of CAL. A prospectus was issued in May 1986, and CA\$47 million worth of common shares and CA\$10 million of preferred shares were sold. At the close of the sale, SNC was listed on the stock exchanges of Montreal and Toronto. The purchase of CAL was also completed in May 1986. Another important event in 1986 was the start of construction of a new headquarters building for The SNC Group in Montreal (Le Groupe SNC Inc., 1987, pp. 5, 7, 23).

The operations of CAL and IVI were brought under SNC Defense Products Limited, headed by Laurent Bergeron, with common central services, such as marketing and administration. As a result, SNC had to renegotiate its overhead rates with the Canadian gov-

ernment. Some price adjustments to CAL's existing contracts were made to account for expenses that it did not incur as a crown corporation, such as insurance costs and provincial taxes. At the same time, the government reduced new ammunition orders, although the primary effect was to reduce SNC's backlog rather than current production. Orders were expected to return to normal in 1987. As part of negotiations with the Department of Energy, Mines, and Resources to renew CAL's licenses to manufacture explosives, SNC agreed to invest CA\$16 million over the next five years to satisfy licensing requirements (Le Groupe SNC Inc., 1987, pp. 15, 23, 27).

SNC defense sales continued to increase in 1987. The CAL subsidiary obtained CA\$150 million and IVI obtained CA\$27 million in new orders, including a combined CA\$23 million in export orders. CAL won development contracts for an improved gas mask, a limited-range tank training round, an artillery training round, and the Canadianization of smoke and illuminating ammunition. Securiplex won a contract to supply fire protection systems to six new Canadian patrol frigates and began the process to qualify its systems for purchase by the U.S. Navy (The SNC Group Inc., 1988, pp. 13–14).

However, defense revenues fell precipitously in 1988 because of an eight-month strike at the Valcartier plant and a reduction in government contracts at CAL. Engineering and construction revenues also fell, and The SNC Group as a whole incurred a loss of CA\$33 million. In the aftermath of the strike, SNC decided to abandon production of sporting ammunition as unprofitable and laid off 150 employees. In July 1988, the Canadian government announced that it was cutting CAL's expected 1989 workload in half. SNC entered into negotiations with DSS to try to obtain a minimum annual workload of 350,000 manufacturing hours and a two-year backlog at contract rates to stabilize ammunition prices and profitability. The company also began a cost-reduction initiative—it downsized manufacturing operations, eliminated unprofitable export production, wrote down the value of assets, moved SNC defense headquarters to Le Gardeur, reduced staff, and made changes in senior management (The SNC Group Inc., 1989, p. 2).

Workload began to stabilize in 1989, but never returned to its 1987 peak. IVI reached a three-year rate agreement with the government, and negotiations were under way for a three-year agreement at CAL. The government agreed to provide 350,000 man-hours of workload at CAL and 200,000 man-hours at IVI. However, this represented a reduction of 100,000 man-hours at IVI, resulting in 100 layoffs. The SNC defense segment began a search for new products and new markets, including training ammunition for police forces, and gas masks and body armor for the Canadian armed forces (The SNC Group Inc., 1990, pp. 13–15, 18).

Efforts to enter new markets were complemented by quality assurance programs in 1990. Rejects of material supplied fell by 39 percent at Le Gardeur, and deviations from standards by 49 percent. Deviations fell by 56 percent at Valcartier. Overall productivity at the three ammunition plants improved by 10 percent. SNC obtained the rights to manufacture luminescent soap-marking training ammunition, which is used to simulate armed exchanges. It also began developing short-range 5.56 mm and 7.62 mm and frangible, lead-free 9 mm and .38 caliber training ammunition. International marketing efforts were increased, with a goal of increasing exports from 5 percent to 45 percent of sales. To reflect the decreased emphasis on defense sales, SNC's manufacturing division was renamed SNC Industrial Technologies Inc. (The SNC Group Inc., 1991, pp. 15–16).

In 1991, SNC acquired the engineering and construction assets of Lavalin, making it the largest engineering-construction firm in Canada. To finance the acquisition, it issued a total of CA\$57.4 million in shares. The Canadian DND announced that it would cut its annual ammunition requirements by 40 percent, resulting in an 18 percent drop in ammunition sales at SNC, although ammunition exports increased from CA\$4.9 million in 1990 to CA\$11 million in 1991. The small-caliber ammunition production lines at Valcartier were transferred to Le Gardeur (load, assemble, and pack) and St Augustin (metal parts). The move required an 8,000 square meter expansion at Le Gardeur and a 7,700 square meter expansion at St Augustin. To improve manufacturing flexibility for smaller production runs, the company invested CA\$4 million in improved information and management systems and subsequent training. SNC also

brought a lawsuit against the government of Canada, claiming damages of CA\$66 million related to the acquisition of CAL in 1986 (The SNC Group Inc., 1992, pp. 2–4, 14–17).

SNC signed its first global contract for Canadian government orders, valued at CA\$100 million, in 1992. The new approach to contracting was intended to reduce costs and share the savings between SNC and the Canadian government. SNC acquired the SIMUNITION technology from Armiger Corporation to expand its product line in nontoxic marking ammunition. Total quality management initiatives were introduced to reduce product development time and to increase the acceptance rate of materials from suppliers from 58 percent to 95 percent (The SNC Group Inc., 1993, pp. 11–12).

The SNC-Lavalin Era

Following the acquisition of Lavalin, the renamed SNC-Lavalin Group Inc. continued to expand its nondefense businesses while defense revenues remained relatively flat. After two years of lowered defense revenues in 1993 and 1994, ammunition sales recovered to the CA\$170–200 million range for the remainder of the 1990s, primarily through increased international sales. SNC continued efforts to reduce ammunition production costs to improve the competitiveness of its products in international markets. The SIMUNITION product line was a strong contributor to export growth. In addition to its own manufacturing activities, SNC began acting as a “make or buy” contractor for DND, under which it investigated munitions technologies, negotiated purchases, and in some cases assembled final products (SNC-Lavalin Group Inc., 1997, pp. 18, 25–26, 55).

In 1997, SNC negotiated a new ten-year agreement with the Canadian DND, confirming its position as a “preferred supplier” through 2006. It also won two R&D contracts with the U.S. military (SNC-Lavalin Group Inc., 1998, p. 16). In 1998, it won a multimillion dollar, multiyear contract to load, assemble, and pack 120 mm mortar rounds for the U.S. Army, as well as a smaller contract for 81

mm mortar rounds (SNC-Lavalin Group Inc., 1999, p. 13). SNC-Lavalin's ammunition subsidiary was renamed SNC Technologies Inc. in 1999. Anthony Rustin, the subsidiary's president and CEO, retired and was replaced by Robert Leboeuf. A consortium including SNC-Lavalin won a contract to finance and operate Highway 407 in the greater Toronto area on a 99-year lease, which contributed to the company's large increase in revenues over the next few years (SNC-Lavalin Group Inc., 2000, pp. 3–4, 51).

By 2000, when deliveries began on the U.S. 120 mm mortar contract, international sales had grown to 35 percent of SNC TEC's revenues, and it continued to expand international sales to the United States, France, Belgium, and Australia (SNC-Lavalin Group Inc., 2001, pp. 13, 19). In December 2001, SNC TEC acquired some of the assets of EXPRO Chemical Products Inc., a producer of extruded propellant located in Valleyfield, Quebec. Its revenues of approximately CA\$60 million per year increased defense sales by approximately 25 percent, but this growth was dwarfed by SNC-Lavalin's expansion of its engineering and construction business and other nondefense acquisitions (SNC-Lavalin Group Inc., 2002, pp. 7–9, 20). For example, in May 2002, SNC-Lavalin took over contracts to build U.S. thermal power plants from NEPCO, which was in financial difficulties, resulting in a CA\$800 million increase in revenue and 5,000 additional employees (SNC-Lavalin Group Inc., 2003, pp. 7, 35, 42). Thus, although SNC TEC is Canada's primary conventional ammunition supplier, it is now only a small part of a much larger conglomerate whose main focus is on engineering and construction.

U.S. and Canadian Export Policies

The governments of Canada and the United States have generally similar policy statements with respect to the exportation of defense materiel. Both recognize the inherent right of nations to self-defense and the need for militaries and military equipment in pursuit of that right. Additionally, both realize the importance of arms export as a tool of national and foreign policy. In practice, however, there are some important differences in the way the two countries implement their respective policies that appear to result in stricter arms export control in Canada.¹

According to the Government of Canada, (2002b, foreword), Canada closely controls the export of military goods and technology to countries

- a. that pose a threat to Canada and its allies;
- b. that are involved in or under imminent threat of hostilities;
- c. that are under U.N. Security Council sanctions; or

¹ Canada's arms exports are controlled by the Export and Import Permits Act (R.S. 1985, c. E-19), which gives the Minister of Foreign Affairs regulatory responsibility. The management of Canadian arms export controls is carried out by the Export and Import Control Bureau of the Department of Foreign Affairs and International Trade. Likewise, in the United States, arms exports are controlled by the Arms Export Control Act (22 U.S.C. 2778-2780) and regulated by the International Traffic in Arms Regulations (22 C.F.R. Parts 120-130). The Department of State is primarily responsible for U.S. arms export policy and compliance; duties are managed by the Directorate of Defense Trade Controls in the Bureau of Political-Military Affairs.

- d. whose governments have a persistent record of serious violations of the human rights of their citizens, unless it can be demonstrated that there is no reasonable risk that the goods might be used against the civilian population.

The United States' basic statement of purpose in controlling the export of military equipment is contained in the Arms Export Control Act.²

In furtherance of world peace and the security and foreign policy of the United States, the President is authorized to control the import and the export of defense articles and defense services and to provide foreign policy guidance to persons of the United States involved in the export and import of such articles and services.

Decisions on issuing export licenses under this section shall take into account whether the export of an article would contribute to an arms race, aid in the development of weapons of mass destruction, support international terrorism, increase the possibility of outbreak or escalation of conflict, or prejudice the development of bilateral or multilateral arms control or nonproliferation agreements or other arrangements.

The most significant difference between the two statements appears to be the Canadian requirement for a reasonable human rights record in the destination country. This requirement highlights two major distinctions between Canada and the United States. First, the United States is a global superpower, while Canada is not. The relative position of the two countries can result in differing approaches to foreign policy. While both countries pursue foreign policy goals in their own national self-interest, Canada can be more ideological because of its stable national security position and the limits on its relative global power. The different political systems also play a significant role. The U.S. Constitution makes "separation of powers" a major theme in the functioning of the government. Under this sys-

² Sections (a)(1) and (a)(2), 22 U.S.C. 2778.

tem, the legislative branch generally defers to the executive branch with regard to foreign policy. In Canada's parliamentary system, the executive branch is much more closely entwined with the parliament; hence foreign policy tends to hew more to domestic political opinion. These political and geostrategic differences between Canada and the United States result in practical differences in the administration of export license issuance. In Canada, the Foreign Minister, also a member of parliament, reviews all license applications for the export of defense materiel to all countries, except for NATO members and a few other close allies. In the United States, the Deputy Assistant Secretary for Defense Trade Controls, a career civil servant, is responsible for issuing export licenses. Notification that a license application was approved is provided to the U.S. Congress, which has only a limited time to pass legislation barring the planned export. This is a rarely used authority. Instead, and in line with the greater emphasis on the separation-of-powers doctrine in the United States, Congress has delegated to the President wide latitude to regulate the exportation of defense-related materiel as a matter of foreign policy.³

As noted elsewhere in this report, the huge differences in the sheer size and scope of the Canadian and American defense industrial base also create significant differences in export opportunities. The United States produces a much broader array of defense materiel and so can appeal to many more markets than can Canadian industry. In addition, even in those segments of the defense market where Canadian companies compete, the United States will often have more than one competitor to match Canadian efforts. For example, whereas Canada has only one significant manufacturer of military ammunition, the United States has several (e.g., General Dynamics, Alliant, and Winchester). While difficult to quantify, such scale and scope discrepancies may translate into export advantages for U.S. defense industries. Additionally, in an absolute (though not necessarily relative) sense, the scale and scope differences can translate into greater political influence for U.S. defense industry at a policymaking level.

³ In specific cases, Congress will take a more active role, such as in the limitations on exports to state sponsors of terrorism, but such cases are rare [50 U.S.C. 2405(j)].

In the period 1999 through 2001 (the latest three-year period for which both the Canadian and U.S. governments posted data), the United States exported \$34 billion in defense materiel to 157 countries, while Canada exported approximately one-thirtieth that amount to 75 countries (see Table B.1). The regional distribution of destination countries is also significant. The United States sent about half its defense-related exports to countries in the Middle East and about a third to its allies in East Asia. European allies made up only 13 percent of the total. While the dollar amount is not large, the United States also licensed defense-related exports to a large number of countries in other regions of the world that do not have the best reputations for democracy or human rights. Canadian defense-related export patterns are strikingly different. Nearly 85 percent of its exports go to regions and countries dominated by Western style democracies. Additionally, the number of countries receiving Canadian arms exports in politically troubled parts of the world, with the exception of the Middle East, is very much smaller than in the U.S. case.

Table B.1
U.S. and Canadian Exports of Defense Materiel by Region (1999–2001)

	Number of Countries Exported To		Value of Exports (Thousands of Constant 2002 \$US)		Percentage of Total Dollar Value of Exports	
Balkans	5	1	51,260	527	0%	0%
Caribbean	17	2	11,917	47	0%	0%
South Asia	9	3	34,446	16,612	0%	2%
Sub-Saharan Africa	32	6	36,393	20,906	0%	3%
Central America	8	2	72,725	1,963	0%	0%
South America	13	9	869,910	21,669	2%	3%
Pacific	7	2	971,804	87,974	3%	11%
Europe	35	25	4,475,405	488,756	13%	59%
East Asia	11	9	11,396,821	106,844	32%	13%
Middle East	17	13	17,823,094	89,481	50%	11%
Total	154	72	35,743,774	834,779	100%	100%

United States

Canada

SOURCES: U.S. deflators are from U.S. DoD, 2003. Canadian deflators are from Bank of Canada, 2004a. The basis for the conversion of Canadian dollars to U.S. dollars is from Bank of Canada, 2004b.

Valuation of Canadian Arsenals Limited

Hix et al. (2003b) estimated possible sales values of U.S. Army ammunition plants based on commonly used financial valuation methodologies. Because these plants do not maintain accounting records according to generally accepted accounting principles, Hix et al. were limited to approaches based on plant revenues. The valuations were based on financial statistics for the closest Standard Industrial Classification (SIC) codes; Miscellaneous Chemical Products, including explosives (SIC code 289) for LAP operations and energetic materials production; and Miscellaneous Fabricated Metal Products (SIC code 349) for metal parts plants, as reported in Ibbotson Associates (2001).

Unfortunately, we were unable to obtain comparable financial statistics for 1985, the year CAL was privatized. However, we can attempt to adjust some of the financial statistics for differences between U.S. inflation and risk-free interest rates (as represented by U.S. treasury bills) in 2001 and Canadian inflation and risk-free interest rates (as represented by Canadian treasury bills) in 1985.

The main valuation methodology used in Hix et al., (2003b) was discounted cash flow (DCF) valuation. The general formula for DCF valuation is $V = (1 - Tc)(1 + g)(OM)(R)/(WACC - g)$, where

- V = value of enterprise
- Tc = marginal corporate tax rate (in 2001, the maximum U.S. federal rate was 0.35)
- g = expected nominal revenue growth (i.e., inflation)

- OM = operating margin (industry average over the previous five years from Ibbotson Associates, 2001)
- R = expected total real annual revenues (based on 2001 revenues at each ammunition plant)
- $WACC$ = weighted average cost of capital (industry average based on the capital asset pricing model from Ibbotson Associates, 2001).

For the purpose of valuing CAL, we used the 1985 Canadian inflation rate of 4.0 percent, based on the Canadian Consumer Price Index (Government of Canada, 2003b). We also adjusted the $WACC$ to account for the difference between the interest rate on U.S. treasury bills in 2001 (3.45 percent) and the interest rate on Canadian treasury bills in 1985 (9.43 percent), as reported in International Monetary Fund (2002, p. 104). We were not able to adjust for differences in corporate tax rates or operating margins. However, a higher tax rate would imply a lower valuation, and a higher operating margin would imply a higher valuation, *ceteris paribus*.

Table C.1 shows the results of the DCF calculations for CAL. Since CAL was involved in both metal parts production and LAP operations, we report calculations based on operating margins and $WACC$ s for both SIC codes mentioned above. We also report 85 percent of DCF, and a DCF valuation with an annual decline in revenues of 10 percent per year, the "base case" and "pessimistic case" valuations, respectively, in Hix et al. (2003b). Since CAL annual reports provide information on actual operating income, we can also base DCF calculations on 1985 operating income of CA\$13.677 million as well as industry average operating margins multiplied by 1985 revenues (CA\$104.497 million). For comparison purposes, the actual sales price of CAL was CA \$92.225 million.

The secondary valuation methodology used in Hix et al., (2003b) was the "multiple of sales" methodology, based on the formula $V = R \times M$, where V is the value of the enterprise, R is estimated annual sales, and M is the average firm market capitalization as

Table C.1
Estimated Valuations of CAL (millions of CA\$)

Basis of Valuation	DCF Value	85% of DCF Value "Base Case"	DCF with 10% Declining Value "Pessimistic Case"
Operating margins × revenues, misc. chemical	89.094	75.730	42.326
Operating margins × revenues, misc. metal	76.617	65.125	36.890
Operating income, misc. chemical	72.972	62.027	34.667
Operating income, misc. metal	71.120	60.452	34.243

a multiple of its sales. The actual value to sales ratio (M) of the CAL transaction was CA\$92.225 million ÷ CA\$104.497 million, or 0.8826, in comparison with the 2001 industry averages of 1.2733 for Miscellaneous Chemical Products (SIC code 289) and 1.0911 for Miscellaneous Fabricated Metal Products based on Ibbotson Associates (2001). These ratios were used to calculate the "optimistic case" valuations in Hix et al. (2003b). However, it is not possible to adjust these ratios for differences in financial conditions between Canada in 1985 and the United States in 2001. The differences between the ratios may be partially accounted for by the higher interest rates prevalent in Canada in 1985.

Based on this analysis, it appears that the techniques used to value the U.S. ammunition plants in Hix et al. (2003b) produced reasonable (or even conservative) results when applied to CAL, with appropriate adjustments for differences between the two countries and time periods.

Bibliography

- Australian Defence Industries (ADI), web site, www.adi-limited.com (as of September 30, 2003).
- Bank of Canada, *Consumer Price Index, 1995–present*, Ottawa, Ont., 2004a, www.bankofcanada.ca/en/cpi.htm (as of April 2004).
- Bank of Canada, *dataBANK statistics look-up*, “Historical Currency Converter,” Ottawa, Ont., 2004b (as of April 2004).
- Battilega, John, Randall Greenwalt, David Beachley, Daniel Beck, Robert Driver, and Bruce Jackson, “Australia,” in *Transformations in Global Defense Markets and Industries: Implications for the Future of Warfare*, Washington, D.C.: National Intelligence Council, 2000, www.odci.gov/nic/research_defensemkt.html (as of March 2004).
- Bishop, Matthew, John Kay, and Colin Mayer, *Privatization and Economic Performance*, Oxford, U.K.: Oxford University Press, 1994.
- Canadian Arsenals Limited (CAL), *Annual Reports*, Ottawa, Ont., 1947–76.
- Canadian Arsenals Limited (CAL), *Annual Reports*, Ville Le Gardeur, Quebec, 1977–86.
- Canadian Commercial Corporation (CCC), *Annual Report 2002–2003*, Ottawa, Ont., 2003, www.ccc.ca (as of September 30, 2003).
- Edgar, Alistair D., and David G. Haglund, *The Canadian Defence Industry in the New Global Environment*, Montreal: Queen’s University Press, 1995.
- Government of Canada, Canadian Forces Headquarters, Directorate of History, *Report Number 15*, Ottawa, Ont., November 1967.

Government of Canada, *Chief of Defense Staff, Annual Report 2002–2003*, Ottawa, Ont., 2003a.

Government of Canada, Department of National Defence, *1985–86 Through 1997–98 Estimates, Part III—Expenditure Plan*, Ottawa, Ont.: Minister of Supply and Services Canada, 1985–97.

Government of Canada, Department of National Defence, *1998–99 Estimates, Part III—Expenditure Plan*, Ottawa, Ont.: Minister of Public Works and Government Services Canada, 1998.

Government of Canada, Department of National Defence, *The Defence Portfolio*, Ottawa, Ont., 2002a, www.dnd.ca/menu/consult/current_policy/defence_portfolio/section_7_e.asp (as of October 10, 2003).

Government of Canada, Export and Import Control Bureau of the Department of Foreign Affairs and International Trade, "Export of Military Goods from Canada: Annual Report 2001," December 2002b, www.dfait-maeci.gc.ca/trade/eicb/military/miliexport01-en.asp (as of April 5, 2004).

Government of Canada, *Report of the Auditor General of Canada for 1988*, Ottawa, Ont., 1988, www.oag-bvg.gc.ca/domino/reports.nsf/html (as of September 30, 2003).

Government of Canada, Statistics Canada, "Consumer Price Index, Historical Summary," Ottawa, Ont., September 15, 2003b, www.statcan.ca/english/Pgdb/econ46.htm (as of October 10, 2003).

Government of Canada, Statistics Canada, "Population, Provinces and Territories," Ottawa, Ont., November 6, 2003c, www.statcan.ca/english/Pgdb/demo02.htm (as of October 10, 2003).

Government of Quebec, Culture and Communications, "Liste des fonctions," 2002, www.mcc.gouv.qc.ca/pamu/themes/synthese/ (as of October 7, 2003).

Le Groupe SNC Inc, *Rapport Annuel 1986*, Montreal, 1987.

Hardin, Herschel, *A Nation Unaware: The Canadian Economic Culture*, Vancouver: J. J. Douglas Ltd., 1974.

Haycock, Ronald G., "Policy, Patronage, and Production: Canada's Public and Private Munitions Industry in Peacetime, 1867–1939" in David G. Haglund, ed., *Canada's Defence Industrial Base: The Political Economy of*

- Preparedness and Procurement*, Kingston, Ont.: Ronald P. Frye & Co., 1988.
- Hix, W. M., D. Oaks, B. Held, E. Keating, M. Hynes, and J. Bondanella, *Options for Managing the Army's Arsenal and Ammunition Plants*, Santa Monica, Calif.: RAND, DB-353-A, 2003a, www.rand.org/publications/DB/DB353.
- Hix, W. M., E. M. Pint, J. R. Bondanella, B. Held, M. V. Hynes, D. Johnson, A. Pregler, M. Stollenwerk, and J. Sollinger, *Rethinking Governance of the Army's Arsenal and Ammunition Plants*, Santa Monica, Calif.: RAND, MR-1651-A, 2003b, www.rand.org/publications/MR/MR1651.
- Ibbotson Associates, *The 2001 Cost of Capital Yearbook*, Chicago, Ill., 2001.
- International Monetary Fund, *International Financial Statistics Yearbook*, Washington, D.C., 2002.
- iSixSigma LLC, "The History of Six Sigma," www.isixsigma.com/library/content/c020815a.asp (as of August 14, 2003).
- Kern, Paul, *Briefing to Under Secretary of Defense (Comptroller) on Defense Industrial Base Transformation*, Alexandria, Va.: U.S. Army Materiel Command, March 31, 2003.
- Levac, Mylene, and Philip Wooldridge, "The Fiscal Impact of Privatization in Canada," *Bank of Canada Review*, Summer 1997.
- Library of the Canadian Parliament, *How Canadians Govern Themselves* (4th Edition), www.parl.gc.ca/information/about/process/library/forsey/how-e.htm (as of September 8, 2003).
- McDermid, John, "Privatization: The Canadian Story," briefing, The Carnegie Council Privatization Project, no. 18, March 9, 1993, as cited in D. M. Doubilet, "Privatization and Political Risk: The Canadian Experience," Symposium of Private Investments Abroad, International Comparative Law Centre, Southwest Legal Foundation, Dallas, Tex., 1994.
- McKie, James W., "U.S. Regulatory Policy," in Kenneth Button and Dennis Swain, eds., *The Age of Regulatory Reform*, Oxford, U.K.: Clarendon Press, 1989.
- Nakani, Helen, *Techniques of Privatization of State-Owned Enterprises, Volume II, Selected Country Case Studies*, Washington, D.C.: The World Bank, Technical Paper No. 89, 1988.

NationMaster.com, web site, www.nationmaster.com (as of October 10, 2003).

NATO, *NATO Standardization Agreements*, "STANAG 4107, (Edition 6), Mutual Acceptance of Government Quality Assurance and Usage of the Allied Quality Assurance Publications," August 27, 2003, www.nato.int/docu/stanag/4107/4107.htm (as of March 2004).

Quebec Arsenal, *The Dominion Arsenal at Quebec: 1880–1945*, Quebec, 1947.

Radygin, A., R. Entov, Yudin, Malginor, Gritsun, Bondarev, Predeina, Swain, and Goodfellow, "Privatization in Canada and Lessons for Russia," in *Transformation of Ownership Relationship and Comparative Analysis of the Russian Regions*, Moscow: Institute for the Economy in Transition, 2001.

"Sale of Defense Industry Co ADI Finalized in Australia," *Asia Times Online*, December 1, 1999, <http://www.atimes.com/bizasia/AL01Aa01.html> (as of September 30, 2003).

Savas, E. S., *Privatization and Public-Private Partnerships*, New York: Seven Bridges Press, 2000.

The SNC Group, *Annual Report 1980*, Montreal, 1981.

The SNC Group, *Annual Report 1981*, Montreal, 1982.

The SNC Group, *Annual Report 1982*, Montreal, 1983.

The SNC Group, *Annual Reports 1984 and 1985*, Montreal, 1985 and 1986.

The SNC Group Inc., *Annual Reports for 1987 thru 1992*, Montreal, 1988–93.

SNC-Lavalin Group Inc., *1996 Annual Report*, Montreal, 1997, www.snc-lavalin.com/en/7_0/pdf/rap_96.pdf (as of November 17, 2003).

SNC-Lavalin Group Inc., *1997 Annual Report*, Montreal, 1998, www.snc-lavalin.com/en/7_0/pdf/rap_97.pdf (as of November 17, 2003).

SNC-Lavalin Group Inc., *1998 Annual Report*, Montreal, 1999, www.snc-lavalin.com/en/7_0/pdf/rap_98.pdf (as of November 17, 2003).

SNC-Lavalin Group Inc., *1999 Annual Report*, Montreal, 2000, www.snc-lavalin.com/en/7_0/pdf/rap_99.pdf (as of November 17, 2003).

- SNC-Lavalin Group Inc., *2000 thru 2002 Annual Reports*, Montreal, 2001–03.
- “SNC-Lavalin to Receive Federal Compensation,” *The Toronto Star*, June 30, 1994.
- SNC Technologies, Inc., “Canada Privatization of Government Arsenals: Visit of RAND to SNC TEC, July 14–18, 2003,” briefing, undated.
- SNC Technologies, Inc., “Visit of RAND Corporation,” briefing, July 16, 2003.
- Solomon, Binyam, “The Canadian Defence Industrial Base,” Ottawa, Ont.: Department of National Defence, December 1999.
- U.K. National Audit Office, *Ministry of Defence: Further Examination of the Sale of Royal Ordnance plc*, London: Her Majesty’s Stationery Office, June 20, 1989.
- U.S. Central Intelligence Agency, *The World Factbook*, “Canada,” www.cia.gov/cia/publications/factbook/geos/ca.html#Military (as of October 10, 2003).
- U.S. Department of the Army, Office of the Program Manager for Mortars, “Ammunition Overview Briefing to RAND Corporation,” briefing, September 8, 2000.
- U.S. Department of Commerce, Bureau of Economic Analysis, *National Economics Accounts*, Washington, D.C., www.bea.doc.gov/bea/dn/home/gdp.htm (as of October 10, 2003).
- U.S. Department of Defense (DoD), *National Defense Budget Estimate for FY2003*, Washington, D.C.: Office of the Under Secretary of Defense (Comptroller), March 2002.
- U.S. Department of Defense (DoD), *National Defense Budget Estimate for FY2004*, Washington, D.C.: Office of the Under Secretary of Defense (Comptroller), March 2003, www.defenselink.mil/comptroller/defbudget/fy2004/index.html.
- U.S. General Services Administration, Office of Property Disposal, “New Tools . . . New Approaches to Brownfields . . . Early Transfer Authority,” Washington, D.C.: General Services Administration, October 2003.
- Vickers, John, and George Yarrow, *Privatization: An Economic Analysis*, Cambridge, Mass.: MIT Press, 1988.

Vuylsteke, Charles, *Techniques of Privatization of State-Owned Enterprises, Volume I: Methods and Implementation*, Washington, D.C.: The World Bank, Technical Paper No. 88, 1988.